Five-Year Review Report

Third Five-Year Review Report
for
Re-Solve, Inc., Superfund Site
Town of Dartmouth
Bristol County, Massachusetts

September 2003

Prepared by:

The United States Environmental Protection Agency
Region 1, New England
Boston, Massachusetts

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Prepared by:
The United States Environmental Protection Agency
Region 1, New England
Boston, Massachusetts

EPA
New England

Approved by:

Susan Studlien

Susan Studlien, Acting Director
Office of Site Remediation and Restoration
U.S. EPA, New England

Date:

September 19, 2003

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ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
BAT	Best Available Technology
BFP	Biofilter/phytobed
BTEX	benzene, toluene, ethylene, xylene
CCC	Criteria Continuous Concentration
COC	Contaminant of Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMC	Criteria Maximum Concentration
CVOC	Chlorinated volatile organic compounds
DNAPL	Dense non-aqueous phase liquid
EPA	Environmental Protection Agency
ESD	Explanation of Significant Differences
FDA	Food and Drug Administration
FOSP	Field Operations Support Plan
gpm	gallons per minute
GWTP	Groundwater treatment plant
GWTS	Groundwater treatment system
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
MOM	Management of Migration
MTBE	Methyl-tert butyl ether
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operations and Maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
ppb	parts per billion
ppbv	parts per billion by volume
ppm	parts per million
PRP	Potentially Responsible Party
RAO	Remedial Action Objective

RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Responsible Party
RW	Recovery Well
SARA	Superfund Amendments and Reauthorization Act
Site	Re-Solve, Inc. Superfund Site
SGL	Seasonal Groundwater Low
SVOC	Semi-volatile organic compounds
SOW	Statement of Work (appended to Consent Decree)
TCE	Trichloroethene
TSCA	Toxic Substances Control Act
TtNUS	Tetra Tech NUS, Inc.
µg/L	micrograms per liter
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VOC	Volatile organic compound
WMA	Waste Management Area

ES EXECUTIVE SUMMARY

This is the third five-year review for the Re-Solve Site (Site). The second review, completed in 1998, focused on the remedy for Operable Unit 2 (Source Control) which was completed in 1995. The 1998 five-year review concluded that the source control remedy was protective. This third five-year review focuses on the remedy for Operable Unit 3 (Management of Migration) and was completed in accordance with EPA Guidance OSWER No. 9355.7-03B-P.

Re-Solve, Inc. operated as a waste chemical reclamation facility from 1956 until its closure in 1980. The first ROD for the Site was signed on July 1, 1983. The remedial action work performed under the 1983 ROD is considered to be Operable Unit 1 (OU1). On September 24, 1987, a second ROD was signed for the Site, encompassing both on-site and off-site contamination. The 1987 ROD established two new operable units; the source control component was labeled Operable Unit 2 (OU2), and the management of migration (MOM) component was labeled Operable Unit 3 (OU3).

The 1987 ROD called for site security, excavation and treatment of PCB-contaminated soils and sediments by on-site dechlorination, and treatment of VOC-contaminated groundwater by an on-site process involving metals removal, air stripping, and carbon adsorption. The ROD set cleanup standards for PCBs only for site soil and sediment. The soil cleanup standard was 25 ppm; the sediment cleanup standard was 1 ppm. Site-related groundwater indicator compounds identified in the MOM component of the ROD include trichloroethylene (TCE), tetrachloroethylene (PCE), and methylene chloride. Treatment to 5 parts per billion (ppb) for TCE, PCE, and methylene chloride is expected to reduce other contaminants identified in groundwater to non-detectable levels. Additional groundwater cleanup standards identified in the Consent Decree include all Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act in effect at the time of the entry of the Consent Decree (May 31, 1989), including, but not limited to, lead, vinyl chloride, p-dichlorobenzene, and 1,1-dichloroethylene.

Source Control activities, including site security, excavation and treatment of contaminated soils and sediments, and wetland restoration, were completed in 1994. EPA declared the source control remedy complete in June 1995.

MOM construction, which took place during 1997 and 1998, included the installation of a two-tiered groundwater extraction system. The inner group of four Tier I extraction wells was installed along the eastern boundary of the waste management area (WMA) to contain the DNAPL contamination and prevent migration beyond the WMA boundary. The outer group of four Tier II extraction wells was installed along the eastern boundary of the dissolved VOC plume to treat the groundwater contaminants to the established cleanup standards. Full-scale operation of the MOM remedy commenced on April 27, 1998, using the four Tier I extraction wells. Operation of the Tier II wells commenced on July 27, 1998, in conjunction with the Tier I wells. Monthly average pumping rates for the eight wells have consistently been maintained at the target of 48 gpm since November 1999.

Process monitoring includes sampling and analysis of: groundwater from each extraction well; combined influent to the GWTP; process water at various stages within the treatment system; effluent from the GWTP; sludge and spent carbon produced during plant operation; and influent and effluent vapors from the catalytic oxidation system. The GWTP has operated consistently, with interruptions only for routine maintenance and modifications to the process. Process monitoring has shown that the effluent from the GWTP is complying with the applicable standards established during the remedial design. Environmental performance monitoring includes sampling and analysis of groundwater, surface water, fish tissue, and residential wells and wetlands monitoring. The environmental monitoring data show decreasing concentrations of VOCs in all samples where VOCs had been detected prior to operation of the MOM remedy.

The review of site-related documents, data, O&M procedures, applicable or relevant and appropriate requirements (ARARs), and site inspection notes indicate that the remedy is functioning as intended by the ROD. This judgment has been made based on an evaluation of environmental and process monitoring data that has been collected during operation of the MOM remedy in accordance with the Field Operations Support Plan (FOSP) and EPA-approved modifications to the FOSP; and through a review of O&M procedures and documentation.

Changes in federal ambient water quality criteria (AWQC) have the potential to impact the calculated permit equivalency discharge limits. In particular the AWQC for PCBs has been reduced by more than 60 percent since 1998. A recalculation of the PCB discharge limit and reevaluation of analytical methods with lower detection limits should be considered.

Overall, a review of effluent sampling data indicates that the GWTP is effectively removing contaminants from the influent groundwater stream, and effluent discharges to surface water at the Site are not having a negative impact on the environment. Over the first five years of operation, the GWTP has operated very reliably. Preventative maintenance is completed routinely by the O&M subcontractor. This has resulted in a system that consistently meets the effluent and emission limits established during the design effort.

Institutional controls appear to be effective in preventing the use of groundwater originating from the Site.

By restricting the migration of VOC contamination through hydraulic capture and treating dissolved phase contamination via the GWTP, the MOM remedy appears to be working towards achieving the objective of eliminating the threat to human health and the environment from groundwater and surface water.

Five-Year Review Protectiveness Statement:

The MOM remedy (OU3) for the Re-Solve Superfund Site is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled through institutional controls and the groundwater extraction system. Restrictions on the use of site groundwater and security measures at the Site are effectively minimizing the risk of human contact with contaminated groundwater. The groundwater extraction system is effectively capturing the dissolved-phase plume and restricting the migration of DNAPL without impacting water levels in the restored wetlands. O&M procedures are in place that should maintain the protectiveness of the remedy. However, in order for the remedy to be protective in the long term, permit equivalency discharge limits should be recalculated for contaminants with changes to the AWQC since the last review. In particular, since the current PCB limit is based on an analytical detection limit rather than the AWQC, a recalculation of the limit and consideration of a change in analytical method (e.g. with a lower detection limit) is recommended.

The source control remedy (OU2) was declared complete by EPA in 1995, and judged protective by EPA in the 1998 five-year review. No new information was encountered during this five-year review to indicate that the protectiveness of this remedy has changed. Therefore,

since the remedial actions at all of the OUs are protective, the Site as a whole is protective of human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Re-Solve, Inc.		
EPA ID *(from WasteLAN)*: MAD980520621		
Region: 1	**State: MA**	**City/County: Bristol**
SITE STATUS		
NPL status: Final		
Remediation status (choose all that apply): Operating		
Multiple OUs?* Yes	**Construction completion date:** April 1998 (OU3)	
Has site been put into reuse? Partial ecological reuse via creation of an upland meadow		
REVIEW STATUS		
Lead agency: EPA		
Author name: Joseph F. LeMay		
Author title: Remedial Project Manager	**Author affiliation:** EPA Region I	
Review period: 3/1/03 to 9/30/03		
Date(s) of site inspection: June 4, 2003		
Type of review: Post-SARA		
Review number: 3 (third) **		
Triggering action: 2nd Five-Year Review – September 29, 1998		
Triggering action date *(from WasteLAN)*: 9/29/98		
Due date *(five years after triggering action date):* 9/29/2003		

* "OU" refers to operable unit.

** Five-Year Reviews were completed in 1993 and 1998

Five-Year Review Summary Form, cont'd.

Issues:

- AWQC have changed for cadmium, silver and zinc.

- The human health AWQC for PCBs has been reduced; current discharge limits are not based on AWQC but on analytical detection limits.

Recommendations and Follow-up Actions:

- Recalculate the NPDES permit equivalency limit for cadmium, silver and zinc.

- Recalculate the NPDES permit equivalency limit for PCBs and evaluate alternate analytical methods with lower detection limits.

Protectiveness Statement(s):

The MOM remedy is currently protective of human health and the environment in the short term and exposure pathways that could result in unacceptable risks are being controlled through institutional controls and the groundwater extraction and treatment system. In order for the remedy to be protective in the long term, permit equivalency discharge limits should be recalculated for cadmium, silver, zinc and PCBs. Use of an analytical method with a lower detection limit for PCB concentrations in the effluent should be considered.

The source control remedy was declared complete by EPA in 1995, and judged protective by EPA in the 1998 five-year review. No new information was encountered during this five-year review to indicate that the protectiveness of this remedy has changed. Therefore, since the remedial actions at all of the OUs are protective, the Site as a whole is protective of human health and the environment.

Other Comments:

1.0 INTRODUCTION

The purpose of this five-year review is to determine whether the remedy selected for the ReSolve, Inc. Site (Site) remains protective of human health and the environment. This report summarizes the five-year review process, investigations and remedial actions undertaken at the Site; evaluates the monitoring data collected; reviews, as appropriate, the Applicable or Relevant and Appropriate Requirements (ARARs) specified in the Record of Decision (ROD) for changes; discusses any issues identified during the review; and presents recommendations to address those issues.

The United States Environmental Protection Agency, Region 1 (USEPA) prepared this five-year review pursuant to the Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan. CERCLA §121 states:

> "If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

The USEPA interpreted this requirement further in the National Contingency Plan; 40 CFR §300.430(f)(4)(ii) states:

> "If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

This is the third five-year review for the Site. The first five-year review was completed in July 1993 as a pre-SARA policy review in accordance with the 1983 ROD. The first review was triggered by the December 12, 1993, remedial action start date for the 1983 ROD (Operable Unit 1 (OU1)) which involved the excavation of soils and sediments from source areas on-site. The second five-year review was completed on September 29, 1998, as a post-SARA statutory review in accordance with the 1987 ROD. The second review was prepared two years after

construction of the 1987 ROD comprehensive source control (OU2) remedial action was completed and during the design and construction of the 1987 ROD management of migration (OU3) remedial action.

This third five-year review assesses the protectiveness of the selected remedies for each of the operable units at the Re-Solve Site. This statutory five-year review is required since contaminants remain on the Site above levels that allow for unlimited use and unrestricted exposure. The five-year review was completed in accordance with EPA Guidance OSWER No. 9355.7-03B-P. For sites with both pre-SARA and post-SARA RODs with remedies that leave contaminants on-site, such as Re-Solve, the guidance clarifies that the pre-SARA remedial actions are subject to post-SARA five-year review procedures. Hence, the second and third five-year reviews are considered post-SARA statutory reviews.

EPA conducted this five-year review of the remedial actions selected for the Re-Solve Superfund Site (Site) in North Dartmouth, Massachusetts. Tetra Tech NUS, Inc. (TtNUS) supported EPA in completion of the review under EPA Contract No. 68-W6-0045, W.A. No. 130-FRFE-0118. This review was performed between March and September 2003.

2.0 SITE CHRONOLOGY

TABLE 2-1
CHRONOLOGY OF SITE EVENTS
FIVE YEAR REVIEW
RE-SOLVE SITE
NORTH DARTMOUTH, MASSACHUSETTS

Event	Date
Re-Solve, Inc. begins operating as a waste chemical reclamation facility.	1956
Massachusetts Division of Water Pollution and Control issues Re-Solve a license to collect and dispose of hazardous waste.	1974
Re-Solve facility closes.	1980
Re-Solve, Inc. offers to surrender its disposal license.	10/21/1980
Massachusetts Division of Hazardous Waste agrees to accept Re-Solve's offer, on the condition that all hazardous waste will be removed from the Site.	12/23/1980
Massachusetts Attorney General's office becomes involved due to lack of response from Re-Solve, Inc.	3/1981
Re-Solve, Inc. removes drums and other debris, including buildings, from the Site. Site area covered with an unknown amount of sand.	1981
Massachusetts Department of Environmental Quality Engineering submits a request to EPA to place the Re-Solve Site on the National Priorities List (NPL).	6/19/1981
Re-Solve Site is included in an interim NPL list of 115 priority hazardous waste sites that are eligible for federal assistance as part of the Superfund program.	10/1981
EPA publishes a Remedial Action Master Plan for the Re-Solve Site.	7/16/1982
Remedial Investigation/Feasibility (RI/FS) process initiated to assess the extent of on-site source contamination and evaluate remedial alternatives.	9/1982
Re-Solve Site is placed on the proposed NPL.	12/30/1982
EPA compiles a list of Potentially Responsible Parties (PRPs) and informs each of their potential liability in relation to the Re-Solve Site.	5/1983
RI/FS completed. Four areas identified as contaminant sources. EPA proposes a source control remedial action including: excavation of 7,000 cubic yards of source materials, treatment, and on-site encapsulation.	6/1983
EPA narrows the list of PRPs and begins negotiating to recover past costs and performance of the remedy recommended in the RI/FS.	1983
EPA signs a ROD describing the selected remedial action: excavation of 7,000 cubic yards of source materials, transportation and off-site treatment/disposal, and encapsulation of the Site. A modified remedial action is selected in response to public comments.	7/1/1983

TABLE 2-1 (cont.)
CHRONOLOGY OF SITE EVENTS
FIVE YEAR REVIEW
RE-SOLVE SITE
NORTH DARTMOUTH, MASSACHUSETTS
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Event	Date
Re-Solve Site is placed on the Final NPL.	9/8/1983
EPA initiates an off-site RI/FS to assess the extent of contamination that has migrated beyond the boundaries of the Re-Solve Site.	9/1983
U.S. Army Corps of Engineers (USACE) completes design of the source control remedial action. Quantity of waste requiring disposal increased to 15,000 cubic yards.	11/1983
Construction of the source control remedial action begins.	7/1984
EPA completes the off-site RI, confirming the four major source areas identified during the 1983 RI/FS and indicating that the Site is acting as a continuous source of contamination to off-site groundwater, surface water, and sediment.	2/1985
USACE informs EPA that additional investigations performed to evaluate the effectiveness of the source control remedial action revealed extensive polychlorinated biphenyl (PCB) contamination in soils located up to ten feet below the seasonal-low groundwater table. Construction of the remedial action is stopped.	4/1985
EPA holds a meeting with the PRP negotiating committee to discuss the off-site RI/FS. PRPs are informed of newly discovered contamination and EPA's intent to perform a Supplemental RI. Negotiations between EPA and PRPs cease.	5/3/1985
EPA initiates a Supplemental RI to address the newly discovered on-site PCB contamination.	9/1985
EPA completes the Supplemental RI.	2/1987
EPA meets with the PRPs to discuss the comprehensive FS development strategy for the Site.	3/1987
EPA holds a public meeting to discuss the project schedule, the findings of the Supplemental RI, and the preliminary list of remedial alternatives that are under development for the FS.	3/11/1987
Supplemental FS is released to the public for review and comment.	6/2/1987
EPA meets with the PRPs and a representative from the Town of Dartmouth to discuss EPA's Proposed Plan for site remediation.	6/1987
EPA holds a public information meeting to discuss the proposed plan and Supplemental FS. Public comment period extended to July 31, 1987.	6/23/1987
EPA holds a public hearing to allow the public the opportunity to enter oral comments into the record.	7/1/1987

TABLE 2-1 (cont.)
CHRONOLOGY OF SITE EVENTS
FIVE YEAR REVIEW
RE-SOLVE SITE
NORTH DARTMOUTH, MASSACHUSETTS
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Event	Date
A second ROD is signed for the Site requiring excavation and on-site treatment of PCB-contaminated soils and sediments (source control), and treatment of volatile organic compound (VOC)-contaminated groundwater by an on-site process involving metals removal, air stripping, and carbon adsorption (management of migration).	9/24/1987
Re-Solve, Inc. and the Settling Defendants enter into an Easement and Restriction Agreement to prohibit the use of the Waste Management Area, including the underlying groundwater, after all of the remedial activities are completed.	5/22/1989
A group of 224 parties that contributed hazardous substances to the Site (Settling Defendants) enter into a Consent Decree with EPA, resolving their liability for the cleanup.	5/31/1989
Management of Migration (MOM) Pre-Design Report submitted.	12/21/1990
Source Control pilot tests completed.	6/1992
Source Control Pre-Design Report submitted.	10/2/1992
EPA issued an Explanation of Significant Differences (ESD) to decouple the ROD-specified dechlorination process from the low-temperature thermal desorption process for on-site soil treatment. Organic liquid residual waste to now be shipped directly to an off-site RCRA- and TSCA-permitted incinerator for disposal.	6/11/1993
Responsible Parties (RPs) begin the source control remedial action.	6/21/1993
First Five-Year Review Report completed.	7/1993
RPs complete the source control remedial action.	12/21/1994
EPA determines that all of the source control closeout issues have been adequately addressed and declares the source control remedy complete.	6/21/1995
A second Restriction Agreement is executed between Re-Solve, Inc. and the Settling Defendants to clarify the scope of the deed restrictions and conform them to the precise wording of the Consent Decree and SOW.	7/17/1995
EPA completes the Final Source Control Remedial Action Report.	2/1996
Final Approval of the MOM Groundwater Treatment Plant (GWTP) 100% Design.	10/23/1996
Construction of the GWTP begins.	8/20/1997

TABLE 2-1 (cont.)
CHRONOLOGY OF SITE EVENTS
FIVE YEAR REVIEW
RE-SOLVE SITE
NORTH DARTMOUTH, MASSACHUSETTS

Event	Date
GWTP construction complete. RPs commence full-scale operation of the MOM remedy.	4/27/1998
An Easement and Non-Interference Agreement is executed between the Settling Defendants and Mr. and Mrs. John Reed, granting access to their property to perform work relating to the Consent Decree.	6/11/1998
Second Five-Year Review Report completed.	9/29/1998
Construction and startup of biofilter/phytoremediation pilot field study.	8/02 – 12/02
Third Five-Year Review completed.	9/03

3.0 BACKGROUND

Re-Solve, Inc. operated as a waste chemical reclamation facility from 1956 until its closure in 1980. The Site was placed on the Final NPL on September 8, 1983. The first ROD for the Site was signed on July 1, 1983. The remedial action work performed under the ROD signed in 1983 is considered to be Operable Unit 1 (OU1). On September 24, 1987, a second ROD was signed for the Site, encompassing both on-site and off-site contamination. The 1987 ROD established two new operable units; the source control component was labeled Operable Unit 2 (OU2), and the management of migration component was labeled Operable Unit 3 (OU3).

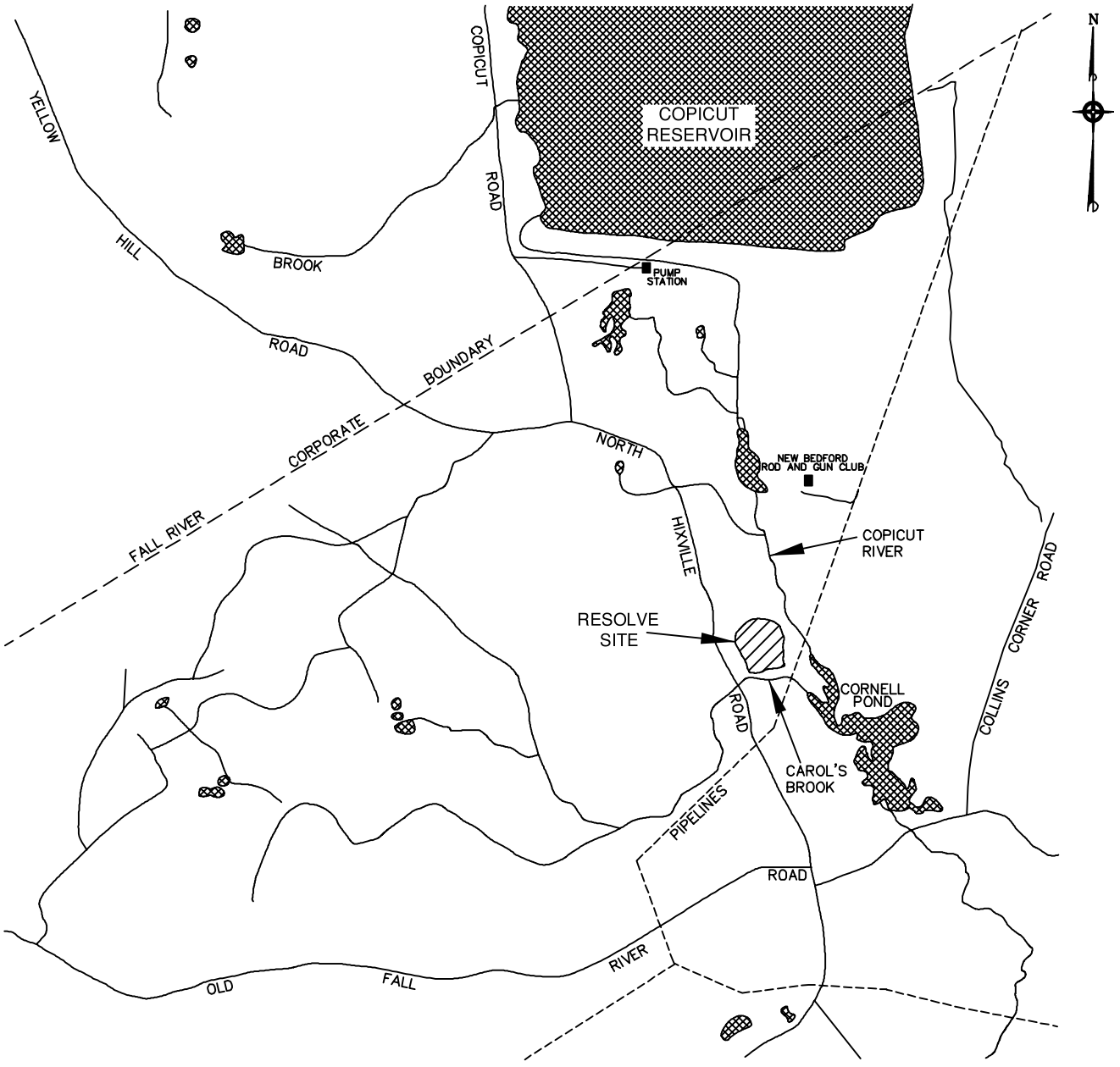
3.1 Physical Characteristics

The Site is located approximately two miles north of I-95 and the Reed Road interchange (see Figure 3-1) in the northern part of Dartmouth, Massachusetts. The Site is bounded by wetlands to the north and east and a pine and mixed hardwood forested areas to the south and west. The west side of the Site is an upland area with a gradual slope to the east. There is a steeper slope on the north and east edges of the Site leading to the two wetland areas. An Algonquin Gas Pipeline right-of-way abuts the eastern side of the Site.

The Copicut River, Carol's Brook, and an unnamed tributary are located along the east and south sides of the Site and drain into Cornell Pond which is in the immediate vicinity of the Site. The Copicut Reservoir lies less than one mile north of the Site. The Site is located over an aquifer that serves as a local drinking water source for private residential wells. Groundwater flows to the east and southeast across the Site, toward the Copicut River and the unnamed tributary.

The overburden consists of permeable sands and gravels ranging in thickness from less than 10 feet to approximately 28 feet. A till layer generally is found below the sands and gravels in contact with the bedrock. The till layer varies in thickness from 0 to over 25 feet. Many large boulders were found in the overburden during excavation of the contaminated soils.

Bedrock fractures have been documented in shallow bedrock but the orientation of the fractures is not known (M&E, 1994). Groundwater in the fractured bedrock aquifer flows in a similar direction as flow in the overburden aquifer.



NOTES:
1. ALL LOCATIONS ARE TO BE CONSIDERED APPROXIMATE.
2. PLAN NOT TO BE USED FOR DESIGN.

GRAPHIC SCALE
0' 500'

SITE LOCATION MAP			FIGURE 3-1
FIVE-YEAR REVIEW REPORT			
RESOLVE SITE – NORTH DARTMOUTH, MA			
DRAWN BY:	R.G. DEWSNAP	REV.:	0
CHECKED BY:	P. CALL	DATE:	JUNE 27, 2003
SCALE:	AS SHOWN	ACAD NAME:	DWG\5966\0600\FIG_3-1.DWG

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

3.2 Land and Resource Use

The Site is located within an Aquifer Protection District Area 3. According to Town of Dartmouth zoning by-laws, the purpose of the Aquifer Protection District is to protect existing and potential groundwater supplies and recharge areas, particularly those areas which contribute to the public water supply. Area 3 is the least restrictive of the three area designations and includes potential groundwater development areas and those areas that provide recharge to Area 2 (which is the recharge area of a public water supply well). Commercial, industrial, and residential developments are permitted in Area 3 with certain restrictions. A number of new homes and small housing developments have been constructed in the area off Reed Road, south of Old Fall River Road and the Site.

The land surrounding the Site is also subject to the underlying zoning, Single-residence B, which allows only single-family residential uses and is more restrictive than the Aquifer Protection District Area 3 by-laws. No changes to the Site's Aquifer Protection District area designation or to the Site's underlying zoning are anticipated.

The Rod and Gun Club of New Bedford owns approximately 180 acres northeast of the Site. The land is used for hunting, fishing, and target shooting. The Dartmouth Natural Resource Trust holds 25-acres of land immediately south of the Site bordering the Algonquin Gas Pipeline right-of-way and the Copicut River. A town forest is located about two miles south of the Site, adjacent to I-95. No rare or endangered species, plants, or animals have been reported within a two-mile radius of the Site.

Three residences are located within 150 yards of the Site, one to the northwest, one to the west, and the other to the southwest. Six other residences are found along North Hixville Road within one-quarter mile of the Site. All residences in the area obtain water from private wells located on their property. The closest public drinking water supply wells are approximately 3 miles south of the site along Route 6. As of January 1, 2001, the population of Dartmouth (which includes North Dartmouth) was 30,431.

The Copicut River, classified as Class B by the Commonwealth of Massachusetts, is located along the eastern edge of the Site. Class B waters are designated for protection and propagation of fish, other aquatic life, and wildlife, and for primary and secondary contact

recreation. Carol's Brook is located along the southern edge of the Site and drains into the Copicut River. The Copicut River drains directly into Cornell Pond approximately one-quarter mile downstream from the Site. Cornell Pond, while not stocked, is popular for sport fishing and has been designated as a secondary water supply for the City of Fall River. Wetland areas have been delineated at the north, east and south boundaries of the Site, around the course of the Copicut River from north of the Site, south toward Cornell Pond and also across North Hixville Road from the Site. Approximately half of the eastern portion of the Site lies within the 100-year floodplain of the Copicut River.

3.3 History of Contamination

Re-Solve, Inc. operated as a waste chemical reclamation facility from 1956 until its closure in 1980. Re-Solve handled a number of hazardous materials, including solvents, waste oils, organic liquids and solids, acids, alkalies, inorganic liquids and solids, and PCBs. Residues from a distillation tower, liquid sludge waste, impure solvents, and burned tires were disposed of in four on-site unlined lagoons. Oil wastes from the distillation tower were spread, or landfarmed, in one portion of the Site and were also used to control dust throughout the Site. Cooling water from the distillation tower was discharged to a shallow on-site lagoon.

In December 1980, the Massachusetts Division of Hazardous Waste agreed to accept Re-Solve Inc.'s offer to surrender its hazardous waste disposal license on the condition that all hazardous waste be removed from the Site. After the Massachusetts Attorney General sued Re-Solve, Inc. and its principals, in late 1981, Re-Solve, Inc. removed drums and other debris, including buildings, from the Site. The Site was then covered with a large quantity of sand. The contents of the four on-site lagoons, cooling pond, and oil spreading operation were not removed.

3.4 Initial Response

EPA commenced a Remedial Investigation and Feasibility Study (RI/FS) to assess the extent of on-site source contamination and evaluate remedial alternatives in the fall of 1982. The RI/FS was completed in June of 1983. This study identified the on-site contamination source as approximately 3,100 cubic yards of lagoon wastes and 3,900 cubic yards of contaminated soil.

In July 1983, a ROD was signed by the EPA Regional Administrator that selected a source control remedy for the Site. This ROD called for the excavation of approximately 7,000 cubic yards of soils contaminated with PCBs at concentrations greater than 50 parts per million (ppm), for off-site disposal and site capping as the source control remedy (OU1). During the remedial design however, the estimated quantity of soils with PCB concentrations greater than 50 ppm was increased to 15,000 cubic yards. Excavation activities began in July 1984. The remedial action was terminated in 1985 because studies conducted near completion of excavation activities to evaluate the effectiveness of the remedial action indicated that extensive PCB contamination existed beyond the previously estimated limits of contamination. Site capping did not occur.

An Off-Site RI/FS, completed in 1985, indicated that the Site was acting as a continuous source of contamination that was migrating off site and impacting groundwater, surface water, and sediment. When the initial source control remedy was terminated in 1985, a supplemental RI was undertaken to further define the extent of on-site PCB contamination. The Supplemental RI was initiated in September 1985 and completed in February 1987. The results indicated approximately 31,000 cubic yards of soil were contaminated with volatile organic compounds and approximately 61,000 cubic yards of soil were contaminated with PCBs. The report also documented contamination of on-site and off-site groundwater with volatile and semi-volatile organic compounds (SVOCs) and PCBs, contamination of downgradient surface water by VOCs, PCB and VOC contamination of sediments, and PCB contamination of fish.

3.5 Basis for Taking Action

A second ROD was signed on September 24, 1987. The second ROD included: site security; excavation and treatment of PCB-contaminated soils and sediments by on-site dechlorination; and treatment of VOC-contaminated groundwater by an on-site process involving metals removal, air stripping, and carbon adsorption. The ROD set soil and sediment cleanup standards for only PCBs. The soil cleanup standard was 25 ppm; the sediment cleanup standard was 1 ppm. Site-related groundwater indicator compounds identified in the ROD include trichloroethylene (TCE), tetrachloroethylene (PCE), and methylene chloride. Treatment to 5 parts per billion (ppb) for TCE, PCE, and methylene chloride is expected to reduce other compounds identified in groundwater to non-detectable levels. Additional groundwater cleanup standards identified in the Consent Decree include all Maximum Contaminant Levels (MCLs)

established under the Safe Drinking Water Act in effect at the time of the entry of the Consent Decree (May 31, 1989), including, but not limited to, lead, vinyl chloride, p-dichlorobenzene, and 1,1-dichloroethylene.

The source control component of the remedy is OU2 and the management of migration (MOM) component of the remedy is OU3. The 1987 ROD also required deed restrictions and other institutional controls to ensure non-interference with the performance of the work and prohibit the use of the Waste Management Area (WMA), including the groundwater beneath the WMA, after completion of the remedial action. The Responsible Parties (RPs) formed the "Re-Solve Site Group" and assumed responsibility for Site remediation.

On May 31, 1989, a Consent Decree was entered under which the parties agreed to perform the EPA-selected remedy and reimburse EPA for certain response costs. This resolved the liability of 224 generator parties (Settling Defendants) who contributed hazardous substances to the Site. In September 1989, the United States entered into an administrative settlement with 170 additional generator parties to help cover the cost of the response actions at the Site. In 1990, an action was filed against 19 parties that had refused to join in the prior settlements. In March 2003 a final settlement was announced with the last of over 400 PRPs named as defendants in the various enforcement actions filed in 1989 and 1990 (EPA, 2003). This settlement also included reimbursement for response costs.

4.0 REMEDIAL ACTIONS

This section describes the source control and MOM remedial actions selected for and implemented at the Re-Solve Site under the 1987 ROD.

4.1 Source Control (OU2)

The source control component of the 1987 ROD was completed in 1995 and is briefly summarized below.

4.1.1 Remedy Selection

The remedy selected in the 1987 ROD included excavation of PCB-contaminated soils located in the unsaturated zone to the seasonal groundwater low (SGL), excavation of PCB-contaminated wetland sediment, and on-site treatment using a dechlorination facility. The ROD required that the disturbed wetlands be restored to their original condition through a wetland restoration program. The ROD also required air monitoring during excavation activities using sampling stations located at the perimeter of the Site.

The ROD set the source control PCB soil cleanup level at 25 ppm in the Waste Management Area (upland area) and at 1 ppm in the wetland sediment. The soil cleanup levels were established only for the unsaturated zone because it was not considered reasonable to assume human health contact with soils below the groundwater table. EPA based the source control soil cleanup level of 25 ppm on a 10^{-5} cancer risk level for potential dermal exposure for the average case under future site use conditions. EPA considered the following factors in selecting the PCB sediment cleanup level of 1 ppm: the range of PCB sediment concentrations (0.13 ppm to 2.5 ppm) associated with adverse impacts to benthic organisms; the location and concentration of PCB contamination; and, adverse environmental impacts.

4.1.2 Remedy Implementation

Based on pilot tests, the dechlorination (DeChlor) system was eliminated from the full-scale remediation, leaving the low-temperature thermal desorption (X*TRAX) system for treatment of the PCB-contaminated soils. Full-scale treatment of PCB-contaminated soils and sediments

was completed between June 21, 1993, and July 19, 1994; site demobilization was completed on December 21, 1994. A total of approximately 36,000 cubic yards of PCB-contaminated soils were excavated, treated, and backfilled on site in the WMA. Approximately 1,500 cubic yards of PCB-contaminated wetland sediments (at PCB concentrations greater than 1 ppm) were excavated; sediments with PCB concentrations less than 25 ppm were backfilled on site. A portion of the excavated sediments (210 cubic yards) had PCB concentrations greater than 25 ppm and thus required treatment prior to backfilling in the WMA. After all treated soils and sediments were backfilled, the WMA was graded and an 18-inch gravel cap was placed over the WMA.

Wetland restoration was performed according to the Wetland Restoration Plan during the summer of 1994. By the June 1995 inspection, the combined total vegetative cover was within the range considered indicative of a successful restoration.

EPA, the Massachusetts Department of Environmental Protection (MADEP), and EPA's oversight contractor conducted a number of site inspections to inspect the completion of the source control remedy. During a June 21, 1995, inspection, EPA determined that all the source control closeout issues had been adequately addressed and declared the source control remedy complete.

4.1.3 Operation and Maintenance

Following the June 1995 completion of the source control remedy, long term operation and maintenance (O&M) activities were performed until the MOM remedy began in 1997. The O&M activities included inspections of the gravel cap, annual surface water monitoring of the Copicut River for PCBs, and wetland inspections. Once MOM construction activities began in 1997, source control operations and maintenance activities were considered complete; the MOM contractors retained responsibility for long-term operations and maintenance activities.

The Re-Solve Site Group voluntarily constructed a native New England grass/wildflower meadow on the Site during June and July 1999. The meadow replaced the 18-inch gravel cap installed at the completion of the source control remedial action. This beneficial ecological reuse was intended to reestablish native species at the Site and enhance wildlife habitat. Following construction of the meadow, inspections were completed in September 1999 and

annually between 2000 and 2002 in accordance with the RP contractor's (ENSR) July 1999 meadow monitoring plan.

4.2 Management of Migration (OU3)

The MOM component of the 1987 ROD included treatment of VOC-contaminated groundwater by an on-site process. The ROD estimated it would require 10 years to achieve the groundwater remediation level; however, this period will likely be extended due to the presence of dense non-aqueous phase liquids (DNAPL) at the Site (which was not known at the time of the signing of the 1987 ROD).

4.2.1 Remedy Selection

The MOM remedy in the 1987 ROD specified active restoration of the overburden and bedrock aquifers contaminated with VOCs using on-site treatment involving air stripping and carbon adsorption. Since EPA determined that it was not feasible to remediate PCBs in the saturated zone, the MOM remedy specified implementation of institutional controls on groundwater use within the waste management area boundary.

Site-related groundwater indicator compounds identified in the ROD included TCE, PCE, and methylene chloride. Treatment to 5 ppb for TCE, PCE, and methylene chloride is expected to reduce other compounds identified in groundwater to non-detectable levels. Additional groundwater cleanup standards identified in the Consent Decree include all MCLs established under the Safe Drinking Water Act in effect at the time of the entry of the Consent Decree (May 31, 1989), including, but not limited to, lead, vinyl chloride, p-dichlorobenzene, and 1,1-dichloroethylene. The three indicator compounds and these four additional compounds are referred to as Site contaminants of concern (COC).

The ROD called for reinjection of treated groundwater into the aquifer to encourage flushing of the contaminants. This portion of the remedy was removed during the MOM design process based on the following assumptions:

- Source control remediation was assumed to mitigate the need for soil flushing since soils above the seasonal groundwater low (SGL) level in VOC-hot spot areas were excavated

and treated. The minimal remaining VOC contamination (i.e., soils above SGL not excavated) would be addressed by degradation or by natural flushing due to precipitation.

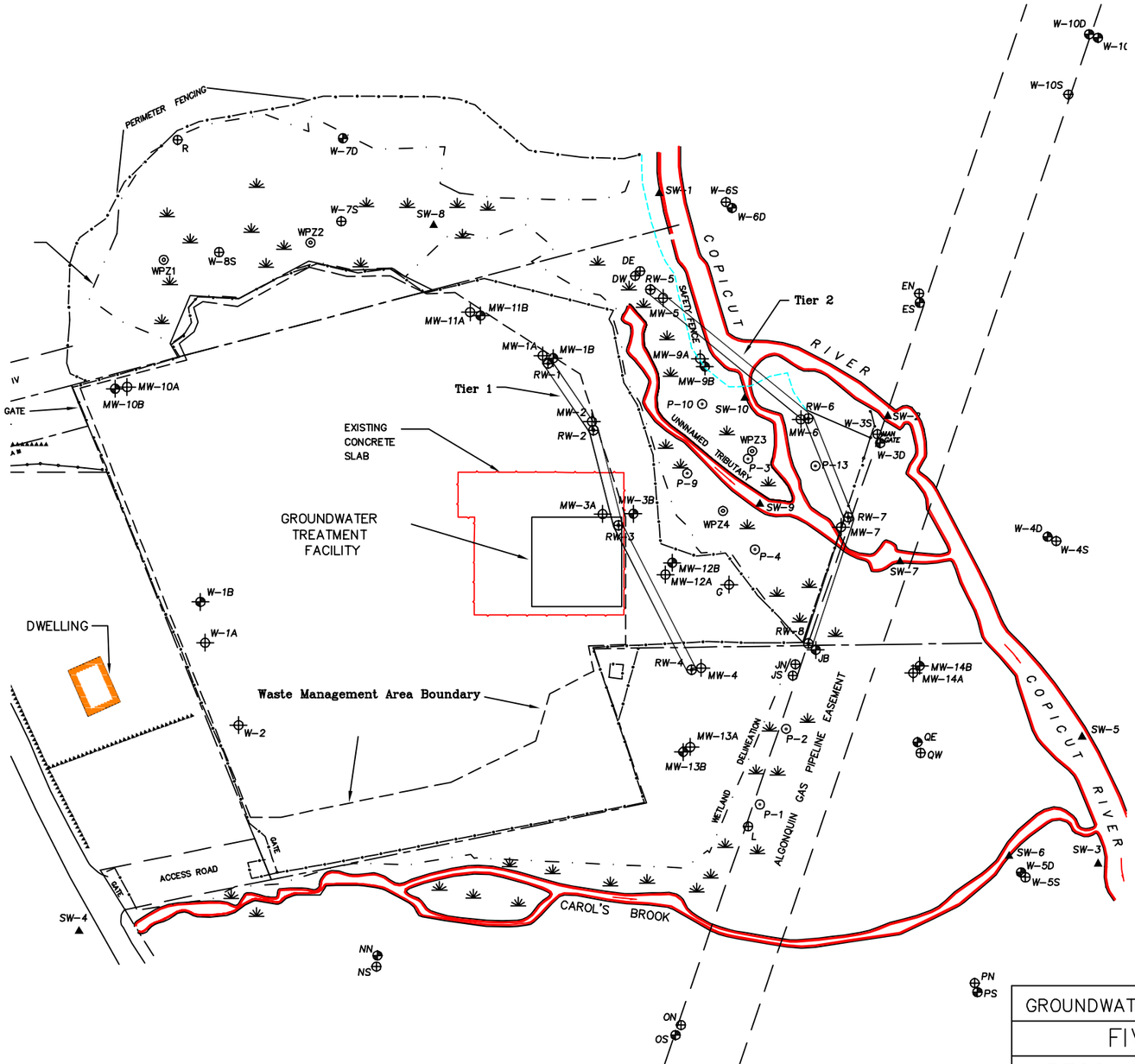
- Also, groundwater-modeling simulations showed that the inclusion of reinjection wells might pose a risk of remobilizing DNAPL. Treated groundwater is discharged directly to the Copicut River in compliance with National Pollutant Discharge Elimination System (NPDES) equivalency discharge limits.

4.2.2 Remedy Implementation

MOM construction, which took place during 1997 and 1998, included the installation of a two-tiered groundwater extraction system (see Figure 4-1). The inner group of four groundwater extraction wells, or recovery wells (RW), referred to as Tier I (RW1 to RW4), was installed along the eastern boundary of the WMA to contain the source area contamination and prevent migration beyond the WMA boundary. The outer group of four groundwater extraction wells, referred to as Tier II (RW5 to RW8) was installed along the eastern boundary of the dissolved VOC plume to clean up the contamination to the established cleanup standards. Twenty-five new monitoring wells were installed to supplement existing wells to form a network used for both water level measurements and water quality sampling.

The groundwater treatment system (see Figure 4-2) includes the following process units: phase separator, equalization, metals oxidation, chemical precipitation, sludge thickening, sludge dewatering, multi-media filtration (for supplemental metals removal), air stripping, carbon adsorption, and surface water discharge of treated effluent.

Equipment, performance, and operations testing were completed in accordance with the final Field Operations Support Plan (FOSP). Following review of the test results, EPA granted approval and the RPs commenced full-scale operation of the MOM remedy on April 27, 1998. Only the four Tier I extraction wells were run for the first three-months of operation; the Tier II wells were started up on July 27, 1998. EPA and the MADEP conducted a pre-final inspection on June 11, 1998, and identified minor “punch list” items requiring completion.



N

LEGEND

- RW-1 ⊕ EXTRACTION WELL
- EXISTING FENCE LINE
- UTILITY EASEMENT
- UTILITY EASEMENT
- WETLAND DELINEATION
- MW-1B ⊕ BEDROCK MONITORING WELL (INSTALLED BY WESTON)
- MW-1A ⊕ OVERBURDEN MONITORING WELL (INSTALLED BY WESTON)
- W-3D ⊕ BEDROCK MONITORING WELL (INSTALLED BY OTHERS)
- W-3S ⊕ OVERBURDEN MONITORING WELL (INSTALLED BY OTHERS)
- SW-1 ▲ SURFACE WATER STATION
- P-1 ⊙ WETLAND PIEZOMETER (INSTALLED BY WESTON)
- WPZ1 ⊙ WETLAND PIEZOMETER (INSTALLED BY OTHERS)
- RW-1 ⊕ GROUNDWATER EXTRACTION WELL (INSTALLED BY WESTON)

GRAPHIC SCALE

0′ 120′ 240′

1 INCH = 120 FEET

NOTES:

1. ALL LOCATIONS ARE TO BE CONSIDERED APPROXIMATE.
2. PLAN NOT TO BE USED FOR DESIGN.
3. BASEMAP FROM A PLAN BY WESTON, ENTITLED: "BASE MAP", DATED: OCT. 97, ORIGINAL SCALE: 1"=60', MASS GRID COORDINATE SYSTEM – NAD 1927.

GROUNDWATER EXTRACTION WELLS & TREATMENT SYSTEM

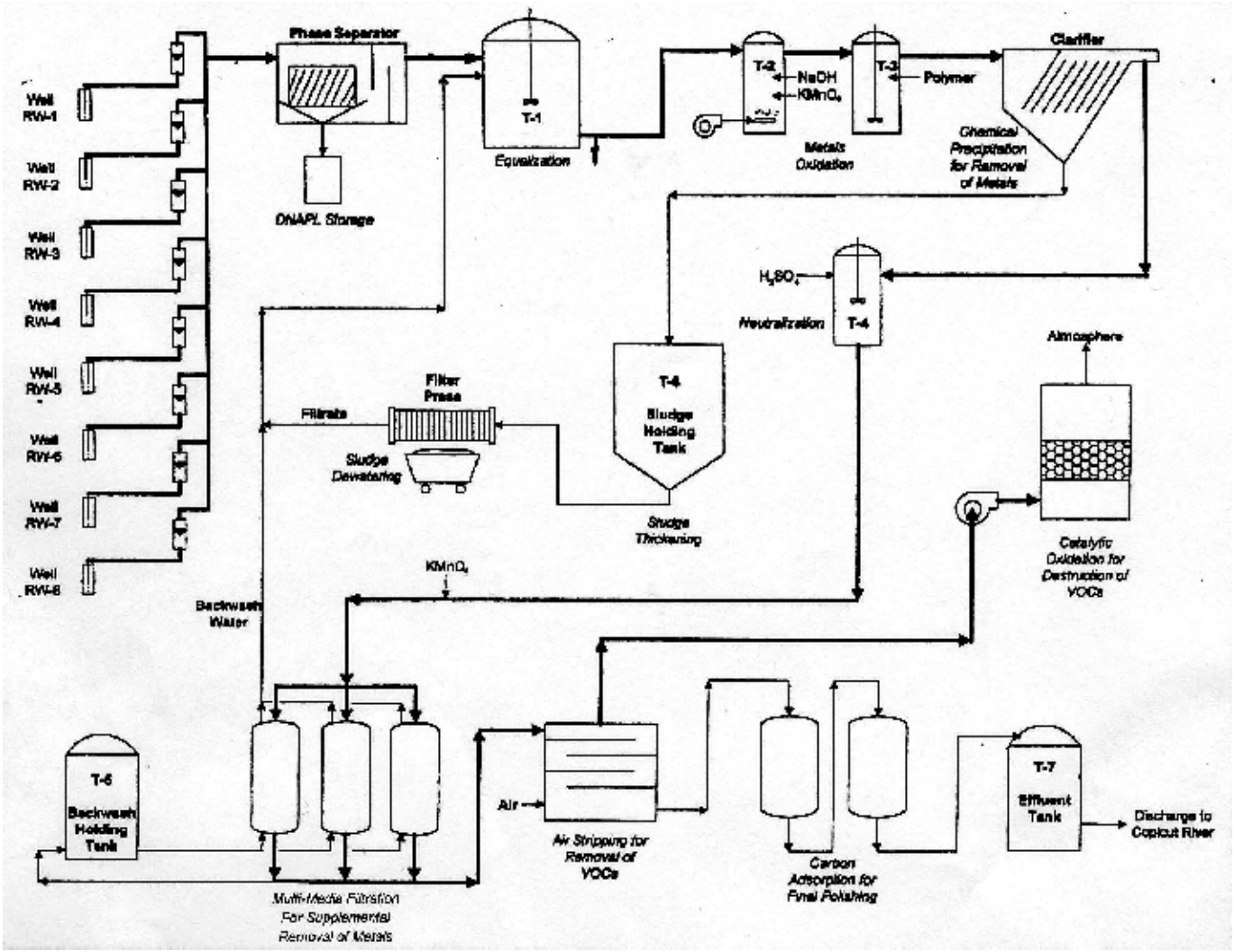
FIVE–YEAR REVIEW REPORT

RESOLVE SITE – NORTH DARTMOUTH, MA

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	P. CALL	DATE:	JUNE 26, 2003
SCALE:	1" = 120'	FILE NO.:	DWG\5966\0600\FIG_4-1.DWG

FIGURE 4–1

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658–7899



NOTES:

1. DIAGRAM PROVIDED BY ENSR.

GROUNDWATER TREATMENT SYSTEM FLOW DIAGRAM			FIGURE 4–2
FIVE–YEAR REVIEW REPORT			TETRA TECH NUS, INC.
RESOLVE SITE – NORTH DARTMOUTH, MA			55 Jonspin Road Wilmington, MA 01887 (978)658–7899
DRAWN BY:	R.G. DEWSNAP	REV.:	0
CHECKED BY:	P. CALL	DATE:	JUNE 23, 2003
SCALE:	NONE	FILE NO.:	\DWG\5966\0600\FIG_4–2.DWG

4.2.3 Operation and Maintenance

The operation and maintenance (O&M) phase of the MOM remedy includes operation and maintenance of the groundwater treatment plant (GWTP), process monitoring of the treatment system, and environmental performance monitoring. Process monitoring includes sampling and analysis of: groundwater from each extraction well; combined influent to the GWTP; process water at various stages within the treatment system; effluent from the GWTP; sludge and spent carbon produced during plant operation; and influent and effluent vapors from the catalytic oxidation system. Process monitoring is intended to determine the effectiveness of operation of the primary unit processes within the GWTP and compliance with effluent discharge and air emission criteria.

Environmental performance monitoring includes sampling and analysis of groundwater, surface water, fish tissue, and residential wells, and wetlands monitoring. Performance monitoring for groundwater will provide the basis for evaluating whether the cleanup standards are being attained downgradient of the Tier I (DNAPL source containment) extraction wells and, if so, whether one or more of the Tier II (dissolved plume containment and remediation) extraction wells can be shut down. As the groundwater cleanup proceeds, it is expected that the outer set (Tier II) of extraction wells will be successively shut down, followed by interim monitoring to ensure that cleanup standards continue to be attained downgradient of the wells. The Tier I extraction well system will continue to operate to prevent migration beyond the WMA.

Tier II compliance monitoring of groundwater will be performed for the entire area downgradient of the Tier I extraction well system following shutdown of the entire Tier II extraction well system (i.e., upon remediation of the dissolved plume) to determine whether the cleanup standards continue to be attained downgradient of the Tier I extraction wells. Comprehensive compliance monitoring will continue for 3 years following the shutdown of all extraction wells to determine that the ROD-specified cleanup standards continue to be satisfied.

A similar sequence of comprehensive compliance monitoring will be completed should cleanup standards be attained for the Tier I extraction wells. Performance monitoring results for surface water, wetlands, fish, and residential wells will be used to demonstrate that there are no detrimental impacts to these media.

4.3 Institutional Controls

Institutional controls, as required by the 1987 ROD, Consent Decree, and SOW, include site security, land access and deed restrictions. Institutional controls concerning site security are in place on-site and include fencing, a secured front gate, bilingual warning signs along the perimeter fence and Site boundary, and the provision of bilingual warning signs, regarding elevated levels of PCBs, to the Dartmouth Board of Health for placement along the Copicut River and Cornell Pond.

Land access has been ensured through an Easement and Non-Interference Agreement, executed on June 11, 1998, between the Settling Defendants and Mr. and Mrs. John Reed (adjacent property owners). This Agreement grants access to property owned by the Reeds to facilitate sampling and maintenance activities in connection with the implementation of the MOM Remedy and ensures non-interference in the conduct of such work. The 1998 Agreement modifies and supersedes the terms of an earlier Easement and Non-Interference Agreement, dated July 8, 1989. The 1998 agreement was recorded on June 26, 1998, at the Bristol County Registry of Deeds.

Restrictions on future use of the WMA have been ensured though an Easement and Restriction Agreement executed on May 22, 1989, between Re-Solve, Inc. and the Settling Defendants. A second Restriction Agreement was executed on July 17, 1995, to clarify the scope of the existing restrictions and conform them to the precise wording of the Consent Decree and SOW. These restrictions are perpetual and will remain in force after the completion of the work. The goal of these deed restrictions is to prohibit the use of the WMA, including groundwater thereunder, after all remedial activities are completed. The second deed restriction was entered on August 4, 1995, at the Bristol County Registry of Deeds.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the third five-year review for the Re-Solve Site. The previous five-year review (EPA, 1998) concluded that the source control remedy achieved the cleanup performance standards established in the ROD and Consent Decree. The review also concluded that based on available operations data for the GWTP, the MOM remedy was expected to be protective of human health and the environment when completed. The GWTP was designed to adequately remove metals to meet recalculated discharge limits resulting from changes to the AWQC used to establish the permit equivalency limits during the remedial design. The review included the following recommendations:

- Consideration of an alternate analytical method for PCBs in effluent to allow for lower detection limits, and thus a lower discharge limit.
- Recalculation of effluent discharge limits to reflect the increase in system flow from 40 gpm to 50 gpm.
- During the compliance monitoring period, monitor p-Dichlorobenzene (1,4) concentrations to ensure compliance with the Massachusetts MCL (5 ppb).

The RPs provided the agencies with recalculated effluent discharge limits in October 1998 based on the increase in system flow. Since the last review, the MOM remedy has continued to operate in an O&M phase. The fifth year of O&M ended in April 2003. The GWTP has operated consistently, with only occasional interruptions for either routine maintenance or non-routine activities, such as carbon changeouts, filter media changeout, and installation of new equipment. O&M activities are reported on a monthly basis, and include the prior month's effluent discharge data, a continuous record of the monthly effluent pH, and aquatic toxicity data (as required based on monitoring frequency).

System monitoring and environmental monitoring continue at the frequencies agreed to by the agencies. The environmental monitoring requirements are summarized in Table 5-1. EPA approved modifications to the original FOSP requirements in September 2000 and December 2001 (see Table 5-1). The modifications included a reduction in the number of annual residential well locations; reduction in the frequency of wetland piezometer, groundwater elevation and surface water measurements, and wetland assessments; modification of the number and frequency of sampling of wells included in the water quality monitoring program;

TABLE 5-1
ENVIRONMENTAL MONITORING
FIVE-YEAR REVIEW
RE-SOLVE INC. SITE
NORTH DARTMOUTH, MASSACHUSETTS

MONITORING COMPONENT	Original FOSP Requirement	Revised Requirement	Performed During the 5th Year of O&M
Quality Monitoring			
Groundwater Quality Monitoring	Quarterly monitoring at 42 wells	Annual Monitoring in May at 42 wells, quarterly monitoring at 17 wells, semi-annual monitoring at 19 wells (Approved by EPA December 14, 2001; Effective February 2002)	Annual monitoring in May at 42 wells, quarterly monitoring in Aug. at 19 wells (SE &SW included), semi-annual in Nov. monitoring at 21 wells (PN &PS included), quarterly monitoring at 17 wells in Feb.
Surface Water Quality Monitoring	Quarterly monitoring at SW-1 and SW-3; annual monitoring at SW-2, 6 and 7	Annual monitoring at SW-1, 2, 3, 5, 6 and 7 (Approved by EPA September 14, 2000; Effective May 2000)	Annual monitoring at SW-1, 2, 3, 5, 6 and 7 ***(No change)***
Residential Well Sampling	Annual monitoring at 16 wells	Annual monitoring at 9 wells (Approved by EPA September 2000; Effective May 2000)	Annual monitoring at 9 wells ***(No change)***
Fish Sampling	Annual sampling for modified list of up to 6 species	Annual sampling for trout, eel, brownhead, perch and largemouth bass (Approved by EPA September 2000; Effective May 2000)	Annual sampling for trout, eel, brownhead, perch and largemouth bass ***(No change)***
Hydraulic Monitoring			
Groundwater Level Measurements	Monthly monitoring at 65 wells	Quarterly monitoring at 65 wells (Approved by EPA September 14, 2000; Effective May 2000)	Quarterly monitoring at 65 wells ***(No change)***
Surface Water Measurements	Monthly monitoring at SW-1 through SW-10	Quarterly monitoring at SW-1 through SW-7 (Approved by EPA September 14, 2000; Effective May 2000)	Quarterly monitoring at SW-1 through SW-7 ***(No change)***

TABLE 5-1 (cont.)
ENVIRONMENTAL MONITORING
FIVE-YEAR REVIEW
RESOLVE SUPERFUND SITE
NORTH DARTMOUTH, MASSACHUSETTS
PAGE 2 OF 2

Monitoring Component	Original FOSP Requirement	Revised Requirement	Performed During the 5th Year of O&M
Wetlands Water Level and Soil Moisture Measurements	Twice weekly monitoring during March 15 through October 31	Once every other week during March 15 through October 31 (Approved by EPA September 14, 2000; Effective May 2000)	Once every other week during March 15 through October 31 ***(No change)***
Wetlands Assessments	3 events annually (May, July and September)	2 events annually (May/June and August/September) (Approved by EPA September 14, 2000; Effective May 2000)	2 events annually (May/June and August/September) ***(No change)***

Source: ENSR, 2002c

and reduction in the frequency of surface water quality monitoring. All of these changes were initially proposed by the RPs and after review and evaluation of the potential impacts, EPA and MADEP agreed to certain modifications that would ensure sufficient monitoring to continue to assess the protectiveness and adequacy of the MOM remedy. The environmental monitoring performed during the fifth year of O&M is shown in Table 5-1. As shown in Table 5-1, during the fifth year of O&M, the RPs added wells SE, SW, PN and PS to the monitoring well network. These wells were included in the annual monitoring event beginning in the sixth year of O&M (May 2003) increasing the total number of wells from 42 to 46.

The RPs prepared and submitted a Work Plan in July 2001 describing a planned pilot field study using a biofilter and phytoremediation system. This biofilter/phytobed, or BFP, pilot study was presented to EPA and MADEP as a potential alternative groundwater treatment approach using natural processes and as a means of significantly reducing energy use (propane and electricity) associated with the current groundwater treatment system. The three-year pilot study was approved by the agencies, constructed during the summer of 2002, and operated in a start up phase with treated groundwater through the fall of 2002. Untreated groundwater at a flow of approximately 0.2 gpm, was introduced to the pilot system in December 2002. The GWTP will continue to operate normally during the period of the BFP pilot study.

6.0 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the Five-Year Review process and the actions taken by EPA to complete the review.

6.1 Administrative Components

EPA, the lead agency for this five-year review, notified MADEP and the RPs in early 2003 that the five-year review would be completed. EPA issued a scope of work, WAF No. 130-FRFE-0118, to TtNUS, under EPA RAC1 Contract No. 68-W6-0045, on March 10, 2003, to assist EPA in performing the five-year review. The EPA Work Assignment Manager was Joseph LeMay. Dorothy Allen of MADEP was part of the review team.

The schedule established by EPA included completion of the review by September 2003.

6.2 Community Notification and Involvement

EPA issued a press release on May 30, 2003, announcing EPA's review of the progress of the Re-Solve Site cleanup. During implementation of the source control remedy in the early 1990s, there were a number of concerns and complaints of noise, and other issues expressed by the public. During the implementation of the MOM remedy the Site has received little interest from the public.

During visits to the Dartmouth Town Hall and Southworth Public Library on June 4, 2003, representatives from TtNUS briefly described the five-year review process to individuals in the Town Hall and library's research department. According to the individuals interviewed, there has been limited interest in the Site during the on-going MOM activities. There had been a much higher level of interest during implementation of the source control remedy in the early 1990s. The complete Administrative Record, dated September 23, 1987, and a number of source control documents were available at the Southworth Public Library. According to reference librarian, other documents have been received, but have not been put on the open shelves. It can therefore be assumed that the more recent documents have not been used to any great extent.

6.3 Document Review

This five-year review consisted of a review of relevant documents including decision documents and monitoring reports, as specified in the EPA SOW for this review (See Appendix A).

6.4 Data Review

This five-year review included a review of available O&M data that has been collected since startup of the GWTP. O&M data that was reviewed included process and environmental monitoring data as well as O&M cost records. A discussion of the data review is included in the technical assessment presented in Section 7.0.

6.5 Site Inspection

A site inspection was conducted on June 4, 2003, with representatives from the RP's contractor (ENSR), the O&M contractor (Weston), EPA's contractor (TtNUS) and the Town of Dartmouth Environmental Coordinator. The inspection of the GWTP included a review of the groundwater treatment process and inspection of the equipment within the process building. The outdoor portion of the inspection included the East and North Wetland Areas, the restored wildflower meadow, the Algonquin Pipeline right-of-way and the area used for the bio-filter phytoremediation pilot study. A Site Inspection report, including a site inspection check list and site photographs is included in Appendix B.

The WMA is secured by chain-link fence and locking gates and is posted with bilingual signs. Due to past incidents of vandalism, a security system including cameras on the exterior corners of the GWTP building was installed during construction of the MOM remedy. Since the MOM remedy has been operating there have been no incidents of vandalism. The original tray air stripper is stored outside of the building on the concrete pad, along with a number of empty 55-gallon drums and pieces of surplus piping.

The restored meadow portions of the WMA are growing well. Bird boxes, brush piles and sand piles (for turtles) have been placed around the upland portions of the meadow as habitat enhancements. The restored east and north wetlands are well vegetated. Mr. O'Reilly, the

Town of Dartmouth Environmental Coordinator, expressed satisfaction with the appearance of the restored wetland areas.

6.6 Interviews

General discussions and observations were documented during the site inspection on June 4, 2003. Telephone interviews were also completed to supplement the site inspection interviews. The list of individuals interviewed regarding this five-year review is shown in Appendix C.

Mr. Michael Gagne, Dartmouth Executive Administrator, has been familiar with the Site since the 1980s. He stated that although taxes on the Re-Solve property are in arrears, there is no interest on the part of the Town in taking the property for the back taxes. He noted that there is little interest in the Site now but that during implementation of the source control remedy this was not the case. The public has expressed concerns about the recreational use of Cornell Pond, for which there are posted advisories against eating eels due to elevated levels of PCBs and mercury (not a site contaminant). Mr. Gagne suggested that improving the signage and posting warnings around Cornell Pond would be beneficial for public use of the area.

The Tax Assessor's Office confirmed that the owner of record of the Site is Re-Solve, Inc. The Town Clerk confirmed that the zoning by-laws available on the town website reflect the current definitions of zoning classifications and aquifer protection districts.

Mr. Michael O'Reilly, Town Environmental Coordinator, concurred with Mr. Gagne that there is little public concern or interest in the Re-Solve Site at the present time. While the town is actively working to protect open space in North Dartmouth, Mr. O'Reilly stated that there is a lot of available property and agreed with Mr. Gagne that the town would not be interested in any future use of the Site. Mr. O'Reilly participated in the site inspection and noted that he hadn't been to the Site in about five years. He indicated his satisfaction with the success of the wetland restoration, especially the east wetland, as the town had earlier concerns about the success of the planned restoration.

TtNUS contacted the U.S. Fish and Wildlife Service (USFWS), which had been actively involved with the Re-Solve Site during restoration of the remediated wetlands. Mr. Ken Munney

commented that the USFWS is no longer involved with the Site and would only get involved again if EPA requested support due to concerns with the wetlands.

7.0 TECHNICAL ASSESSMENT

This section provides a technical assessment of the MOM remedy (OU3) that is being implemented at the Re-Solve Site. The source control remedy (OU2) was determined to be complete by EPA in June 1995, and the five-year review performed in 1998 determined that the remedy achieved the cleanup performance levels established in the ROD and Consent Decree. For this reason, the technical assessment will address the performance of the MOM remedy only. The technical assessment criteria are outlined in the *Comprehensive Five-Year Review Guidance* (EPA, 2001).

7.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

The review of site-related documents, data, O&M procedures, applicable or relevant and appropriate requirements (ARARs), and site inspection notes indicate that the remedy is functioning as intended by the ROD. This judgment has been made based on an evaluation of environmental and process monitoring data that has been collected during operation of the MOM remedy in accordance with the Field Operations Support Plan (FOSP) and EPA-approved modifications to the FOSP; and through a review of O&M procedures and documentation. This section provides a summary of the information that was evaluated for the five-year review.

7.1.1 Remedial Action Performance and Monitoring Results

Remedial action performance and monitoring information that is collected as part of the MOM O&M phase includes both environmental quality and process monitoring data. The environmental parameters that are monitored as part of the MOM O&M include groundwater quality monitoring (from monitoring wells and residential wells), surface water quality monitoring, contaminant monitoring in fish tissue, wetlands restoration monitoring (through soil moisture and vegetation type analysis), groundwater elevations, and surface water elevations. The process monitoring parameters include groundwater extraction rates, influent contaminant concentrations, and effluent contaminant concentrations, including air emissions. Results of the environmental and process monitoring are discussed below.

Groundwater Quality Monitoring. Groundwater quality data from on-site and off-site monitoring wells have been collected on a quarterly basis since system startup in April 1998. A network of

42 monitoring wells was monitored as part of the first four years of MOM O&M. During the latter part of the fifth year of operations, the RPs added four more wells to the network (SE, SW, PN. PS). At present, each of these 46 wells is monitored on at least an annual basis, 19 of these wells are monitored on a semi-annual basis, and 17 are monitored on a quarterly basis. Monitoring wells are sampled for chlorinated volatile organic compounds (CVOCs) and benzene, toluene, ethylene and xylene (BTEX) compounds as part of the performance monitoring program. The baseline monitoring event, performed in August 1997, included analysis for VOCs, SVOCs, PCBs, and metals.

The most recent complete environmental monitoring round that was available at the time of this five-year review occurred in May 2002. The May 2002 environmental monitoring round was a full monitoring event, including all 42 monitoring wells in the network. An evaluation of groundwater samples collected during this event revealed several detections of COCs that continue to exceed MCLs (ENSR, 2002d). However, contaminants exceeding MCLs were generally concentrated in the area between the two tiers of extraction wells and not at the perimeter of the Site. The contaminant most often exceeding its MCL was vinyl chloride (exceeding 2 µg/L in 9 of 42 wells), with a maximum detected concentration of 860 µg/L (MW-9A, an overburden monitoring well). Monitoring wells MW-9A and MW-12A, both overburden monitoring wells located downgradient of the WMA, had more exceedances than any of the other monitoring wells, with five of the COCs exceeding their respective MCL. In general, the highest concentrations of CVOCs were observed in bedrock monitoring wells (up to 9,400 µg/L TCE and 9,300 µg/L PCE in MW-9B) (ENSR, 2002d).

A qualitative evaluation of the CVOC concentrations over time reveals a majority of the monitoring wells (37 of 42 wells) exhibit either downward trends or concentrations below detection limits/MCLs with no trend. Other monitoring wells revealed fluctuating CVOC concentrations or upward trends. Generally, the concentration trends that were observed for BTEX compounds follow those exhibited by CVOCs.

A quantitative trend analysis was performed in December 2002 by the RP contractor to evaluate the impact of the MOM remedy on contaminant concentrations in groundwater and to determine the statistical significance of concentration trends that have been observed since system startup (ENSR, 2002d). [Note: The trend analysis summary table (ENSR, 2002d) included 43 wells; however well JN is not part of the groundwater quality network (Charbonnier, 2003).] The

results of the RP contractor's trend analysis indicated that CVOC concentrations in 20 of the 42 monitoring wells that were analyzed for this study have exhibited a downward trend since the baseline sampling event in 1997. Nine of these wells contained contaminant concentrations below detection limits during the May 2002 groundwater sampling round (ENSR, 2002c).

The RP contractor reported that according to the trend analysis, 21 of the 42 monitoring wells exhibited no trend. Fifteen of these 21 wells showed a flat line with concentrations below detection limits and two showed a flat line with low (below MCLs) concentrations. Four monitoring wells (MW-12A, MW-12B, W-4D, and W-6D) exhibited fluctuating concentrations with no upward or downward trend, but still contained concentrations of contaminants in excess of their MCLs. According to this analysis, only one well (MW-3A) exhibited an upward concentration trend between April 1997 and August 2002 (ENSR, 2002c).

Nine residential water wells were sampled in May 2002 as part of the annual sampling event. None of the samples contained concentrations of any VOCs above laboratory reporting limits (ENSR, 2002a). Review of residential well sampling results since the baseline sampling event in 1997 revealed very few detections of VOCs in the residential water supply in the vicinity of the Site, none approaching federal MCLs.

DNAPL Well Point Monitoring. DNAPL was discovered in a wellpoint located southeast of the present GWTP building in 1993, during the implementation of the source control remedy. Routine monitoring of the well point for the presence of DNAPL has continued since that time. The last time DNAPL entered the well point and was removed was in January 2000 (Charbonnier, 2003a). Since that time, no further DNAPL has been observed in the wellpoint. The wellpoint continues to be monitored on a weekly basis.

Surface Water Quality Monitoring. The surface water quality monitoring program currently consists of annual monitoring at six surface water stations. The baseline surface water monitoring event included analysis for VOCs, SVOCs, PCBs, and metals; the routine performance monitoring includes only VOCs. Sample data collected during the most recent monitoring round (August 2002) for five of the six stations (SW-7 was dry) indicates that no VOCs were detected above the reporting limit (ENSR, 2002b). This is a decrease from the prior year when acetone was still present at detectable levels (5.0 µg/L) at a surface water sampling station located immediately downstream of the junction between the unnamed tributary and the

Copicut River (SW-5) and the concentrations of 1,1-dichloroethane, toluene, and vinyl chloride detected in surface water samples collected from the unnamed tributary (SW-7) exceeded laboratory reporting limits (ENSR, 2002). Generally, the concentrations of VOCs detected in surface water samples collected from each of the sampling stations have decreased since startup of the MOM remedy.

Fish Tissue Monitoring. The fish tissue monitoring program currently consists of annual sampling for trout, eel, brown bullhead, perch, and large-mouth bass. The fish tissue samples are analyzed for PCBs and percent lipids. Sampling results from the most recent round, performed in September 2002, indicated a concentration of 0.32 milligrams per kilogram (mg/kg) PCBs in brook trout collected from the Copicut River and a range of 0.052 to 0.36 mg/kg PCBs in various fish collected from Cornell Pond (ENSR, 2003). An evaluation of PCB concentrations detected in fish tissue samples collected throughout the five year monitoring period (since startup of the MOM remedy) indicates that very seldom has a fish tissue sample contained PCBs at a concentration that exceeds the Food and Drug Administration (FDA) action limit of 2 mg/kg PCBs. Samples of American eel that were collected in 2001 and large-mouth bass that were collected in 2000 and 2001 exceeded the 2 mg/kg action limit, but sampling results from the most recent event suggest that PCB concentrations in fish tissue from Cornell Pond and the Copicut River continue to decrease. Fish tissue data are presented on Table 7-1.

Wetland Assessment. Subsequent to the MOM baseline wetland assessment conducted in July 1997, routine assessments have been performed over the intervening five years (1998 – 2002). Since the MOM groundwater treatment system became fully operational in July 1998, there has been no documented evidence of negative impacts on the wetlands. Therefore, there has been no need to implement any of the mitigation measures outlined in the MOM FOSP (April 1997).

Various invasive species have been present in both wetland areas since October 1998. Limited physical removal efforts have been made each year since then. Both assessments performed during 2002 noted that grape, cattail, and reed canary grass are increasing in number of locations and size of the areas where the species are already established. While limited removal of invasive species by hand continues to be performed, there has not to date been any suggestion of the use of herbicides to control the expansion of the invasive species. The cattail area at the west end of the Northern Area expanded in size between 2001 and 2002. During

TABLE 7-1
FISH TISSUE SAMPLING ANALYTICAL SUMMARY
FIVE-YEAR REVIEW
RE-SOLVE INC. SITE
NORTH DARTMOUTH, MASSACHUSETTS

Location	Sample	Range of PCB Concentrations (mg/kg) Baseline (1997)	Range of PCB Concentrations (mg/kg) 1st Year (1998)	Range of PCB Concentrations (mg/kg) 2nd Year (1999)	Range of PCB Concentrations (mg/kg) 3rd Year (2000)	Range of PCB Concentrations (mg/kg) 4th Year (2001)	Range of PCB Concentrations (mg/kg) 5th Year (2002)
Copicut River	Brook Trout	0.15 – 0.3	0.08 – 0.24	0.16 – 0.59	0.05 – 0.47	0.062	0.32
Cornell Pond	American Eel	0.42-0.84	0.24 – 0.69	0.51 – 0.76	0.38 – 0.65	0.44 – 2.09	0.23 – 0.36
	Brown Bullhead	NC	0.08 – 0.12	0.06 – 0.32	0.12 – 0.12	0.24	0.055 – 0.079
	Pickerel	NC	NC	0.03 – 0.08	NC	NC	NC
	Large-mouth Bass	0.04 – 0.17	0.03 – 0.11	0.06 – 0.22	0.03 – 2.20	0.2 – 2.2	0.067 – 0.2
	Yellow Perch	0.04 – 0.08	0.02 – 0.04	0.11 – 0.47	0.06 – 0.11	0.2 – 0.37	0.073 – 0.10
	Blue Gill	NC	NC	NC	NC	0.148	0.052 – 0.1

NC = none collected
FDA action limit for PCBs = 2 mg/kg
Source: ENSR, 2001; ENSR, 2002; ENSR, 2003

the June 4, 2003, site inspection, the RP contractor confirmed that there have been no discussions to date regarding the use of herbicides to control invasive species. The 2002 wetland assessment reports noted a diversity of vegetation in both wetland areas comparable to that documented during earlier years. These most recent assessment reports have concluded that the areas monitored contain established wetland plant communities and wetland hydrologic conditions with little evidence of erosion or sedimentation (Weston, 2003; Weston, 2003a).

Groundwater and Surface Water Elevations. Groundwater elevations have been monitored at 66 wells since startup of the MOM remedy. Groundwater elevation measurements were collected monthly for the first two years of operations, and have been collected quarterly since August 2000. An evaluation of groundwater elevation data performed by the RP's contractor suggests that the groundwater extraction system is and has been adequately containing the DNAPL source area, one of the objectives of the MOM remedial design (ENSR, 2002c).

Surface water elevations and flow rates have been monitored from ten surface water stations since startup of the MOM remedy. For the first two years of operations, surface water elevations and flow rates were measured monthly from all ten surface water locations. Since August 2000, surface water elevation and flow rate has been measured quarterly at seven locations. An evaluation of current and historical surface water levels and stream flow rates indicates that drawdown from the groundwater extraction system does not appear to be negatively impacting the wetlands restoration effort. Field observations made during the site inspection support this determination.

Groundwater Extraction Rates. The recommended flow rate in the MOM remedial design was 40 gallons per minute (gpm) with a design capacity of 80 gpm (M&E, 1994). The RP contractor determined that to better ensure hydraulic capture, the system should operate at a minimum monthly average total pumping rate of 45 gpm. A target rate of 48 gpm was established to provide an adequate margin of safety. About the time that the second tier of extraction wells began operating (e.g. July 1998), the RP contractor determined that RW-7 and RW-8 should pump at 10 gpm to better ensure hydraulic capture. Due to yield limitations, RW-2 could consistently pump at only 3 gpm. A review of monthly average pumping rates for extraction wells shows that since November 1999, when adjustments to the groundwater treatment system were designed and implemented, monthly average flow rates that are below the target flow rate have been recorded only four times (ENSR, 2002d). Observations made during the site

inspection confirm that the target pumping rate is being achieved and adequate procedures and controls are in place to ensure that it continues to be achieved.

Treatment Plant Influent and Effluent Sample Collection. Treatment system influent samples have been collected annually for VOCs each April since 2001. Prior to April 2001, influent samples were collected on a monthly basis from January 2000 to March 2001. No treatment influent samples were collected in 1999, and one sample was collected approximately five months after startup in October 1998. Influent concentrations of total VOCs that have been measured during operation of the treatment system (1,000 micrograms per liter (µg/L) to 2,100 µg/L) have been well below the design influent concentration for total VOCs (54,000 µg/L).

Effluent samples have been collected monthly since July 1998 to comply with NPDES permit equivalency requirements. The samples are routinely analyzed for VOCs, SVOCs, PCBs, metals, and total suspended solids. Data from effluent samples that were collected between July 1998 and April 2003 were available for this five-year review. Detectable concentrations of some metals have been observed in effluent samples, but the concentration of lead (which was identified as a contaminant of concern in the ROD) has not exceeded its reporting limit (5 µg/L) since the inception of the effluent sampling program. Arsenic, another inorganic contaminant that has been a source of concern during operation of the GWTP (see Section 7.1.2), has not been detected above its reporting limit since August 2000, when 13 µg/L arsenic was detected in an effluent sample, well below the NPDES Daily Maximum concentration (5,530 µg/L) that was calculated in 1998 for arsenic.

No PCB Aroclors have been detected in any of the monthly effluent samples. The only SVOC detected in an effluent sample since inception of the sampling program was bis(2-ethylhexyl)phthalate, which was last detected in September 2001 at a concentration well below NPDES permit limits. Phthalates are common field and laboratory contaminants. Positive detections of VOCs have been limited to toluene and methyl-tert butyl ether (MTBE) since July 2002, toluene at concentrations well below its NPDES equivalency standards and MTBE at concentrations below the EPA Drinking Water Advisory level of 20 ppb. The last positive detection of a VOC contaminant of concern was in December 2001 when 1 ppb of TCE was detected in an effluent sample. Overall, a review of effluent sampling data indicates that the GWTP is effectively removing contaminants from the influent groundwater stream, and effluent discharges to surface water at the Site are not having a negative impact on the environment.

Other Treatment Plant Monitoring

The sludge generated in the GWTP is run through a filter press and tested for total solids, metals, VOCs, and PCBs prior to transport off-site in 55-gallon drums. The most recent filter cake sample contained 13 mg/kg PCB, Aroclor 1242 only. During the June 4, 2003 site inspection, the O&M contractor reported that the filter cake PCB concentration is typically in this range and thus the drummed filter cake is transported off-site for disposal as non-hazardous, non-TSCA waste. The phase separator (see Figure 4-2) is monitored weekly for DNAPL, but none has been detected. Air emissions from the catalytic oxidizer are monitored annually. Air samples from the influent to the oxidizer and the emissions from the oxidizer are collected and the VOC removal efficiency is calculated. The reported removal efficiencies for the first four years of operation are shown in the table below.

CATALYTIC OXIDIZER MONITORING RESULTS

Year of Operation	Influent VOC Concentration	Removal Efficiency (%)
1	4,148 ppbv	98%
2	2,539 ppbv	94%
3	2,395 ppbv	94.7%
4	2,953 ppbv	95%

Source: ENSR, 2002d

7.1.2 System Operations/O&M

The O&M contractor (Weston Solutions) has operated the system continuously, with brief shutdowns for repairs and maintenance, and infrequent shutdowns of a few days when the new air stripper was installed, new filter media was added to the multi-media filter vessels, carbon was changed out, and for other planned maintenance events. Chemical usage is tracked and reported on a monthly basis. Variations in usage from month to month have been minor and reflect adjustments to the operation of the system such as improvements in the metals precipitation process, and acid to backwash the multi-media filters. The pH of the effluent is continuously recorded to ensure compliance with the effluent discharge limits. Increases in effluent pH typically seen immediately following carbon changeouts are tracked closely, as is the elevation in arsenic concentrations in the effluent, also associated with new carbon.

Routine maintenance typically includes: weekly monitoring of the phase separator for DNAPL; operation of the filter press and shipment of dewatered sludge off-site in 55-gallon drums; cleaning pipelines and the clarifier; replacement of extraction well pump heads with spares from inventory onsite. A number of maintenance items are performed routinely as preventative measures to optimize the operation of the GWTP.

Non-routine maintenance issues have been diagnosed and managed effectively with input from the regulatory agencies. For example, during system startup and also during subsequent carbon changeouts, a spike in pH and elevation of arsenic concentrations in the effluent was observed. In 1998 to remedy this problem, the agencies required that three additional monitoring activities be performed after each carbon changeout: pH monitoring; hourly collection of samples for arsenic analysis; and collection of the monthly effluent sample within 24 hours of restart. Each of these three monitoring activities is described further in the following paragraphs.

The pH must be monitored before the first vessel, after the first vessel, and after the second vessel on a daily basis for three weeks after system restart to ensure the pH declines to acceptable levels. Since 1999, the O&M subcontractor has used acid addition to adjust the pH in the effluent tank. The RP contractor indicated that experience has shown the effluent pH declines to acceptable levels (e.g. below 8.3) in about 10 days (Charbonnier, 2002). When the pH reaches acceptable levels, typically in less than three weeks, the additional pH monitoring is discontinued.

Elevated arsenic concentrations in the effluent immediately after carbon changeout resulted in the agencies requiring collection of hourly effluent samples for the first 24 hours after system restart. The 24 hourly samples are composited into four 6-hour samples and the four composites are analyzed for arsenic. The data reported from the four carbon vessel changeouts completed since system startup in 1998 show arsenic concentrations generally decreasing from over 100 µg/L to approximately 20 µg/L within the 24-hour period. With each data set, the RP contractor has performed calculations to determine whether there was an exceedance of the average monthly arsenic discharge limit of 8 µg/L. The calculations to date have shown that the average monthly limit has not been exceeded.

Also, the agencies required that the monthly effluent sample must be collected within 24 hours of restart following a carbon changeout. This requirement has not consistently been met.

Over the first five years of operation, the GWTP has operated very reliably. Preventative maintenance is completed routinely by the O&M subcontractor. This has resulted in a very effective system that consistently meets the effluent and emission limits established during the design effort.

7.1.3 Costs of System Operations/O&M

The MOM 60% Design (M&E, 1994) included an estimate of annual operating costs of approximately $460,000, based on continuous operation at 40 gpm. The components of the estimated costs included labor (34%), sampling and analysis (29%), energy (25%), chemicals and carbon (8%), and sludge disposal (4%). The annual costs for the fifth year of operation of the GWTP (e.g. through April 30, 2003) at 48 gpm were approximately $431,000 (ENSR, 2003a). The RP contractor confirmed that the year five costs are typical of the costs incurred for years one through four (Charbonnier, 2003b). The largest component of the Year 5 O&M costs is labor (approximately 66%), followed by energy (12%), chemicals (8%), sludge/filter cake disposal (6%), replacement equipment parts (5%), and analytical (3%). The Year 5 costs are summarized in the table below.

YEAR 5 OPERATIONS AND MAINTENANCE COSTS

Cost Item	Year 5 Cost (approximate)	Percent of Total Annual Cost
Labor	$285,000	66 %
Energy	$ 52,000	12 %
Chemicals/Carbon	$ 35,000	8 %
Sludge Disposal	$ 26,000	6 %
Equipment	$ 21,000	5 %
Analytical	$ 12,000	3 %
Total Cost (approximate)	$431,000	100 %

Source: ENSR, 2003a

While the Year 5 labor costs are approximately double the estimated labor costs, the estimated cost for the sampling and analysis may have included labor for sample collection as well as analysis. The actual labor costs do include sample collection. In addition, the labor associated

with preventative maintenance may be higher than that estimated in the design. However, the preventative maintenance appears to result in a well functioning system with minimal down time.

Some potential reasons for the differences in O&M costs include the following. Labor costs higher than estimated may reflect escalation in labor rates, inclusion of incidental spare parts, and labor-intensive preventative maintenance. Actual energy costs are approximately one half of that estimated. This likely reflects design and operating procedures to minimize the costs of operating the plant. Chemical, carbon, and disposal costs relate to the constituents of the groundwater, the flow rate of the system, and the chemistry involved in the treatment process units. The Year 5 disposal costs included filter cake and spent multi-media from the filter vessels; disposal of filter media was not included in the remedial design estimate. The consistency in the annual costs over the past five years indicates that the remedy is operating effectively with minimal down time.

7.1.4 Opportunities for Optimization

Since the GWTP began operation in April 1998, a number of minor changes have been made to the system to optimize the operation over time. The following major modifications have been completed.

- The greensand in the three filter vessels was replaced with a multi-media system in May 1999. Fouling of the greensand resulted in reduced flows to approximately 35 gpm through the system. After evaluation of options, and with the concurrence of the agencies, the media replacement was completed thus allowing the system to operate at the 48 gpm flow rate.

- The original tray air stripper was replaced with a packed tower air stripper in January 2002. Corrosion was initially observed in the cover and top tray of the air stripper in early 2001. After trouble-shooting the problem and evaluating options, the agencies agreed with the RP's recommendation to replace the tray type stripper with a packed tower air stripper.

- The pipeline from RW3 was rerouted to feed directly to the influent tank, T1, in May 2001, bypassing the influent manifold and RW-3 flow meter. This change was made as

a result of continuous fouling of the pipeline and flowmeter due to high iron concentrations in the groundwater from RW-3.

The performance of the system is routinely monitored by the on-site O&M personnel, and, as evident by the above-mentioned modifications, the O&M staff has been effective in identifying opportunities to improve the GWTP, proposing and implementing solutions to optimize the operation of the system. No additional opportunities for optimization were identified during the five-year review process.

7.1.5 Early Indicators of Potential Remedy Problems

No early indicators of potential remedy problems were identified during the five-year review process.

7.1.6 Implementation of Institutional Controls

Institutional controls that are in place at the Site to maintain the protectiveness of the remedy include fencing, signage, and deed restrictions on the use of groundwater originating from the Site. Observations made during the site inspection indicate that the fencing at the perimeter of the Site is in very good condition and is well-marked with warning signs that are legible. All gates are locked during the day, except for the main entrance gate which is left unlocked only when treatment plant personnel are on site. All barbed wire appeared to be intact and no evidence of trespassing was observed during the inspection or reported by the plant O&M staff. An inspection of the Site and interviews with site O&M personnel produced no evidence to suggest that site groundwater is being used in any way that is in violation of the deed restriction that has been placed on the Site.

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of the Remedy Selection Still Valid?

Changes in Exposure Pathways. The ROD identified exposure scenarios for existing site conditions (at the time of the ROD) and potential site development conditions (residential). The primary routes of human exposure to contamination that were identified at the time of the ROD, and that are applicable to the MOM remedy, were through inhalation of VOCs released from

surface water, dermal contact with surface water, and human ingestion of fish. The primary route of human exposure identified under potential site development conditions was the ingestion of on-site groundwater. Exposure pathways associated with the presence of contaminated soil or sediment at the Site are considered eliminated since the source control remedy addressed soil and sediment contamination.

No changes in exposure pathways or land use have occurred since selection of the remedy. Institutional controls, including site fencing, signage, land access restrictions, and deed restrictions have been established, as required by the ROD, Consent Decree, and SOW. These institutional controls appear to be effective in restricting human contact with contaminated media (groundwater, surface water, fish) at the Site. The Site is fenced with barbed wire and secured gates, with warning signs present along the entire length of the fence line. Security cameras are mounted on the outside of the treatment building and provide surveillance of the property from a monitor located in the building's control room. A deed restriction is on file at the Registry of Deeds that prohibits the use of groundwater at the Site. Observations made during the site inspection and records review indicate that these controls are intact and effective at eliminating human exposure pathways that could impact the protectiveness of the MOM remedy.

EPA has supported an annual Cornell Pond Fishing Derby since 1998. The objective of the fishing derby is to involve the public in the collection of the fish species needed for the ongoing environmental monitoring program and also to remind the public of the advisory not to consume eels caught in Cornell Pond and the Copicut River and to practice catch and release. Over the five years that EPA and the RPs have sponsored the fishing derby, the public has actively participated and adequate fish tissue samples have been collected. EPA has publicized the derby on its website and also through town officials and residents.

One potential improvement related to exposure pathways that was recommended by a town official is the installation of additional signage at the public access points to Cornell Pond, located downstream of the Site and subject to a fishing advisory due to PCBs and mercury (not a site contaminant). The official stated that much of the public is aware of the advisory, and there is little concern that town residents are being exposed to risks, but renewed efforts to publicize the fishing advisory would be beneficial.

Changes in Land Use. Land use in the vicinity of the Site is still residential in nature, zoned by the Town of Dartmouth as Single Residence B (SRB). The Site itself is generally not accessed except by the O&M contractor to perform O&M activities.

New Contaminants and/or Contaminant Sources. No new contaminants or contaminant sources have been identified since startup of the MOM remedy. The contaminants detected in groundwater samples are those identified in the ROD as contaminants-of-concern. No toxic byproducts of the remedy were identified during the review.

Changes in Standards or Newly Promulgated Standards. As part of this five-year review, ARARs for the Site presented in the ROD were reviewed, and a review of current ARARs was conducted. Due to the fact that source control remedy has been completed, soil- and sediment-specific ARARs that were cited in the ROD (and those that were added in the ESD) have been met. ARARs identified in the 1987 ROD and current ARARs that are applicable to the MOM remedy include the following:

- Resource Conservation and Recovery Act (RCRA),
- Toxic Substances Control Act (TSCA),
- Clean Water Act (including NPDES),
- Executive Order 11990 (Protection of Wetlands),
- Safe Drinking Water Act (including MCLs and wetland protection), and
- Clean Air Act.

RCRA and *TSCA* are the applicable regulations that are used to determine the proper disposal procedures for filter cake that accumulates from the filter press or for disposal of spent carbon from the vapor-phase carbon adsorption units (see Figure 4-2). DNAPL, if recovered, would also be subject to the disposal requirements established by RCRA (and TSCA, if PCBs were present). As mentioned in Section 7.1.1 (Other Treatment Plant Monitoring), no DNAPL has been collected from the phase separator since the GWTP has been in operation. However, DNAPL removed from the well point located immediately southeast of the treatment plant facility has been collected and disposed of in accordance with RCRA and TSCA regulations. As indicated in Section 7.1.1, no DNAPL has been found in the well point since January 2000. These regulations, as currently constituted, continue to maintain the protectiveness of the remedy.

The *Clean Water Act* is the applicable regulation that provides the statutory basis for the NPDES permit program, which determines the maximum allowable effluent discharge limits for water treated on site. The NPDES permit equivalency limits that are being used were developed in 1998 shortly after the second five-year review for the Site. These limits were calculated using a system flow rate of 50 gpm, with AWQC and Best Available Technology (BAT) limits as the basis for the calculation of permit equivalency limits.

The AWQC that are applicable to the Site include fresh water Criteria Maximum Concentrations (CMC), fresh water Criteria Continuous Concentration (CCC), and human health criteria based on the consumption of fish (M&E, 1994). EPA updated the AWQC, which were used to develop equivalency limits for inorganic contaminants, in 2002 (EPA, 2002). Changes to AWQC for inorganic contaminants since 1998 include the reduction of the CMCs for cadmium from 4.3 µg/L to 2.0 µg/L and for silver from 3.4 µg/L to 3.2 µg/L; the reduction of the CCC for cadmium from 2.2 µg/L to 0.25 µg/L; and the reduction of the human health criteria for consumption of fish for zinc from 69,000 µg/L to 26,000 µg/L. Since none of these inorganics are contaminants of concern for the Site, nor have they been detected at elevated levels (if at all) in effluent samples, the NPDES permit equivalency limits being used for inorganic contaminants in effluent are assumed to be protective of human health and the environment.

BAT limits were used as the basis for the development of discharge permit equivalency limits for most of the organic contaminants for which limits were established. A review of current BAT limits for direct discharge point sources that do not use end-of-pipe biological treatment (40 CFR 414 - Organic Chemicals, Plastics, and Synthetic Fibers), which are considered relevant and appropriate to the GWTP (M&E, 1994), indicate that BAT limits for VOCs and SVOCs that are included in the effluent sampling data have not changed since 1995. Since no changes in BAT limits have occurred since inception of the MOM remedy, the permit equivalency limits being used to evaluate organic contaminant levels in effluent originating from the GWTP remain protective of human health and the environment.

The NPDES permit equivalency limit that is currently used to evaluate the concentrations of PCBs in effluent is based on the detection limit that could be reasonably achieved using the analytical methods available at the time of the 60% Design Report rather than the PCB effluent discharge limit of 0.0033 µg/L established in the 60% Design Report (M&E, 1994). Therefore, the limit that is being used for PCBs does not reflect the AWQC for PCBs that was in effect in

1998. In 2002, EPA lowered the human health criteria for the consumption of fish for PCBs from the 1998 level of 0.00017 µg/L to 0.000064 µg/L. The impact of this change on the protectiveness of the MOM remedy is unclear, but should be evaluated. A further discussion of this issue is presented in Section 8.1.

The *Clean Water Act* and *Executive Order 11990* are the applicable regulations that provided the guidelines for excavation in wetlands and the subsequent restoration of wetlands. No new or modified requirements are contained within these regulations that impact the protectiveness of the MOM remedy.

The *Safe Drinking Water Act* is the legislation that enabled the establishment of MCLs, which are the relevant and appropriate regulations for groundwater located outside of the boundaries of the Waste Management Area. No new or modified MCLs have been established for site indicator compounds since the last five-year review, so the protectiveness of the remedy is not affected.

The *Clean Air Act* was an ARAR established in the ROD that served primarily to regulate air emissions from the on-site thermal desorption unit used during the source control remedial action. At present, it is the applicable requirement used to establish contaminant loading limits for air emissions from the catalytic oxidizer at the groundwater treatment plant. Compliance with this ARAR, as currently constituted, continues to maintain the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics. Chemical-specific concentration thresholds used to assess the risk associated with contaminants present at or in the vicinity of the Site include MCLs, FDA action limits for PCBs in fish, and NPDES permit equivalency limits. MCLs and FDA action limits were not used to develop site-specific goals. Therefore, changes in toxicity or other contaminant concentrations would not impact the protectiveness of the remedy since a site-specific risk evaluation was not used to develop the concentration threshold. NPDES effluent limits were recalculated in 1998 shortly after the previous five-year review report using 50 gpm as the system flow rate and the most recent procedures established by the NPDES permit program. Therefore, they are assumed to be protective of human health and the environment.

Changes in Risk Assessment Methods. Since the target cleanup levels for groundwater outside of the WMA were based on MCLs rather than site-specific risk-based concentrations, changes in risk assessment methods would not affect the protectiveness of the remedy. MCLs and FDA action limits are based on conservative default assumptions (rather than a site-specific risk evaluation).

Expected Progress Towards Meeting RAOs. The following is a summary of the remedial response objectives for the MOM remedy that were established in the ROD with a brief assessment of the progress that has been made towards meeting these objectives.

Reduce risks to human health associated with dermal contact and subsequent absorption with surface water, ingestion of groundwater and inhalation of volatiles released from groundwater and surface water. Analytical results from surface water samples collected as part of the MOM environmental monitoring program have demonstrated a substantial decrease in VOCs since implementation of the remedy. Implementation of the source control remedy and operation of the MOM remedy have had a positive impact on the quality of surface water in the vicinity of the Site and the risks to human health from dermal contact or inhalation of VOCs appear to have been considerably reduced.

An evaluation of contaminant concentrations in monitoring wells that are part of the environmental monitoring network indicates that a majority of the wells (37 of 42 wells) exhibit either downward trends (20 of 42) or concentrations below detection limits/MCLs with no trend (17 of 42). Despite these trends, groundwater contamination persists at other monitoring wells (5 of 42 wells) that have contaminant concentrations above MCLs on portions of the Site, with fluctuating concentration trends observed in four of the five wells and an upward concentration trend in one well (MW-3A).

Despite the presence of contaminants in some monitoring wells that are above MCLs, no evidence was encountered during the five-year review to suggest that human exposure to contaminants through ingestion or inhalation of VOCs is occurring. Analytical results of drinking water samples that were collected from residential water wells in the vicinity of the Site did not show concentrations of VOCs above laboratory detection limits. Also, institutional controls appear to be effective in preventing the use of groundwater originating from the Site for any means.

Eliminate or minimize the threat posed to public health and the environment from the current and potential future extent of contaminant migration in groundwater and surface water. This objective was intended to restore the groundwater in both the overburden and bedrock aquifers beyond the WMA to drinking water standards. The GWTP was designed to remediate the dissolved phase VOC plume in the overburden aquifer while minimizing the mobility of DNAPL, encountered on the Site during implementation of the source control remedy.

Based on data collected over the first five years of operation, it appears that the MOM groundwater extraction well network is controlling the migration of contaminated groundwater beyond the WMA. The GWTP is successfully treating dissolved phase VOCs in the overburden. While a complete review and evaluation of the hydrogeological assumptions is beyond the scope of the five-year review, a hydraulic capture assessment performed by the RP contractor in 2002 suggests that the GWTP is successfully capturing all groundwater that has been impacted by the Site (ENSR, 2002c). DNAPL delineation studies performed in 1993, 1999, and 2002 suggest that the DNAPL areas at the Site have not expanded or migrated significantly over the past ten years (ENSR, 2002c).

An environmental monitoring program, including collection of groundwater, surface water, residential well, and fish samples, continues on a schedule approved by the agencies to assess the effectiveness of the MOM remedy in meeting the ROD-specified RAOs. By restricting the migration of VOC contamination through the groundwater extraction system and treating dissolved phase contamination via the GWTP, the MOM remedy appears to be working towards achieving the objective of eliminating the threat to human health and the environment from groundwater and surface water.

Maintain air quality at protective levels for on-site workers and the public during site remediation. The O&M staff occupies the treatment plant building during regular business hours, five days per week, and represents the greatest potential risk for human exposure to hazardous air emissions. No evidence was encountered during the five-year review to suggest that harmful exposures are occurring in the treatment building. Air quality was monitored daily (using a photoionization detector) within the treatment building for the first month of operations and was determined to be satisfactory. Since then, real-time monitoring of air inside the treatment building occurs only during maintenance events for which air monitoring is required

(e.g. confined space entry). The O&M contractor indicated that this occurs approximately twice yearly, and indoor air quality has never triggered any concern.

7.3 Question C: Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No new information has become available that could impact the protectiveness of the remedy.

7.4 Technical Assessment Summary

Based on a trend analysis of influent contaminant levels performed by the RP contractor, the MOM remedy appears to be generally decreasing the concentration of dissolved VOCs in groundwater located within the environmental monitoring well network. Quarterly and semiannual groundwater monitoring results have shown that contaminant concentrations observed in approximately half of the wells monitored have decreased since startup of the remedy. Of those wells that have not shown a significant decrease in contaminant concentrations, only four exhibited fluctuating concentrations that are above cleanup levels and only one exhibited a significant upward trend.

Fluctuating contaminant levels that have been observed at several monitoring wells suggest that a continuing source of DNAPL exists in groundwater beneath the Site. One of the objectives of the MOM remedial design is to prevent the migration of DNAPL. DNAPL delineation studies performed in 1993, 1999, and 2002 suggest that the MOM remedy has been effective in limiting the mobility of DNAPL in both the bedrock and overburden aquifers.

A reduction in dissolved VOC concentrations in groundwater and effective capture of the groundwater plume by the extraction system also appears to have reduced the discharge of contaminants to the Copicut River. No detectable concentrations of VOCs were found in surface water quality samples collected in August 2002. No detectable concentrations of indicator contaminants were found in the nine residential wells sampled during the May 2002 annual event. A decrease in contaminant concentrations in fish tissue sampled as part of the environmental monitoring program also supports the conclusion that the GWTP is helping to improve environmental conditions in surface water bodies that have been negatively impacted by site contamination.

An analysis of capture zones through groundwater flow modeling performed by the RP contractor has suggested that maintenance of a minimum monthly average pumping rate of 45 gpm should ensure capture of the entire contaminant plume. A review of historical monthly average pumping rates from each of the eight extraction wells suggests that the contaminant plume has been, and should continue to be, adequately contained by the extraction system, as currently constituted. Groundwater and surface water level monitoring performed during operation of the GWTP indicates that a 45 gpm system flow rate does not negatively impact the wetland restoration effort. Observations made during the site inspection support this fact. Wetlands in both the north and east portion of the Site appear adequately reestablished following the restoration performed during the source control remedy.

A full-time O&M technician is on site to monitor the performance of the GWTP and anticipate complications that may compromise the performance of the system. A preventative maintenance schedule has been established, and the O&M contractor has demonstrated the ability to deal effectively and expeditiously with non-routine maintenance issues. O&M costs have generally fallen in line with projections that were made during the 60% design phase of the project.

The exposure pathways and land use assumptions that were stated in the ROD are still valid. No zoning or land use changes have been made since the ROD, and institutional controls appear to be effective in preventing access to the Site and use of the Site's groundwater.

In summary, the GWTP appears to be effective in capturing and treating the dissolved phase VOC plume and minimizing the mobility of DNAPL, all of which appears to be improving the quality of surface water, groundwater, and fish tissue sampled downgradient of the Site. The system is able to do this at a flowrate that does not compromise the restored wetlands by lowering groundwater and surface water levels, and for a cost that falls within a reasonable range of projections.

8.0 ISSUES

The current NPDES permit equivalency limits in use at the Site were calculated in 1998 assuming a system flow rate of 50 gpm and using AWQC and BAT limits to develop daily maximum and average monthly concentrations that are acceptable for a point-source discharge into the Copicut River. Based on a review of GWTP operating records, the 50 gpm assumption remains protective. However, certain changes in federal AWQC have the potential to impact the protectiveness of the MOM remedy.

Of the inorganic contaminants for which AWQC have changed, cadmium seems the most likely to impact the protectiveness of the MOM remedy. The CMC and CCC for cadmium have been reduced by more than half since 1998; the current permit equivalency limit used at the Site for cadmium does not reflect this change. Although cadmium has not been detected in an effluent sample since July 1998, the analytical detection limit for cadmium is equal to the current average monthly discharge limit.

The contaminants for which a change in AWQC is most likely to have an impact on the protectiveness of the remedy are PCBs. The human health AWQC based on the consumption of fish for PCBs has been reduced from 0.00017 µg/L in 1998 to its present value of 0.000064 µg/L. A recalculation of the PCB effluent discharge limit using the new AWQC and the method presented in the 60% Design Report indicates that the new limit would be on the order of 0.004 µg/L, well below the analytical detection limit of 0.5 µg/L that is currently being used as the PCB effluent discharge limit.

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Due to the fact that some of the AWQC that were used as a basis for the development of NPDES permit equivalency limits have changed since 1998, recalculation of these limits for the contaminants discussed in Sections 7.2 and 8.0 may be appropriate. A recalculation of the NPDES permit equivalency limits for cadmium and the other inorganic contaminants for which AWQC have changed (silver and zinc) is recommended to verify that the effluent concentrations meet these limits, thus maintaining the protectiveness of the remedy.

The only organic contaminants for which AWQC or BAT limits have changed are PCBs. The human health criterion for the consumption of fish containing PCBs has been reduced by more than 60 percent since 1998, and the resulting effluent limit calculation yields a concentration threshold that is not attainable using the analytical method currently in use. Since a fishing advisory is in place, restricting consumption of fish caught in the Copicut River and Cornell Pond (the water bodies that have been impacted by the Site), the protectiveness of the remedy should not be effected.

However, since at present the protectiveness of the remedy is dependent upon an institutional control rather than the PCB effluent discharge limit, it is recommended that an alternative analytical method be used to achieve a lower detection limit for PCBs in the effluent. EPA Method 1668, which is currently being used at Superfund sites in EPA Region I, and will soon be promulgated, can achieve the necessary detection limits to ensure the effluent is meeting the calculated PCB discharge limit (EPA, 2003a). Since the cost of EPA Method 1668 (approximately $1,000) is an order of magnitude greater than the routine PCB method ($100) it's use semi-annually is recommended. After one year the methods should again be reevaluated.

10.0 PROTECTIVENESS STATEMENTS

The MOM remedy (OU3) for the Re-Solve Superfund Site is currently protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled through institutional controls and the groundwater extraction system.

Restrictions on the use of site groundwater and security measures at the Site are effectively minimizing the risk of human contact with contaminated groundwater. Since August 1986, an advisory has been in place, and warning signs posted, to ensure that there is no human consumption of eels that are caught in the Copicut River and Cornell Pond; waters that have been impacted by the Site. The groundwater extraction system is effectively capturing the dissolved-phase plume and restricting the migration of DNAPL without impacting water levels in the restored wetlands. O&M procedures are in place that should maintain the protectiveness of the remedy.

The source control remedy (OU2) was declared complete by EPA in 1995, and judged protective by EPA in the 1998 five-year review. No new information was encountered during this five-year review to indicate that the protectiveness of this remedy has changed. Therefore, since the remedial actions at all of the OUs are protective, the Site as a whole is protective of human health and the environment.

11.0 NEXT REVIEW

The fourth five-year review for the Site will be conducted in 2008 since contaminants remain at the Site above levels that allow for unrestricted use of the property.

APPENDIX A

DOCUMENT REVIEW LIST/REFERENCES

DOCUMENTS REVIEWED/REFERENCES CITED

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Appendix B
Site Inspection Report
Is available
in a separate file (size: 2.76 MB)

Click here to view.

APPENDIX C

INTERVIEW LIST

INDIVIDUALS INTERVIEWED FOR THE RE-SOLVE, INC.

FIVE-YEAR REVIEW

Name/Position	Organization/Location	Date
Michael O'Reilly/ Environmental Affairs Coordinator	Conservation Commission, Dartmouth Town Offices/Dartmouth, MA	6/4/03
Michael Gagne/ Executive Administrator	Dartmouth Town Offices, Dartmouth, MA	6/4/03
Donald Perry/Director	Planning Department, Dartmouth Town Offices/Dartmouth, MA	6/4/03
Reference Librarian	Southworth Public Library/Dartmouth, MA	6/4/03
Clerk	Tax Assessors Office, Town Offices/ Dartmouth, MA	6/4/03
Joseph F. LeMay/ EPA RPM	U.S. EPA/Boston, MA	6/5/03
Ken Munney	U.S. Fish and Wildlife Service	6/5/03